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GROWTH IN WORLD DEMAND FOR **FEED GRAINS**

RELATED TO MEAT AND LIVESTOCK
PRODUCTS AND HUMAN
CONSUMPTION OF GRAIN



FOREIGN AGRICULTURAL ECONOMIC REPORT NO. 63

U.S. DEPARTMENT OF AGRICULTURE



ECONOMIC RESEARCH SERVICE

ABSTRACT

World grain consumption by livestock is expected to reach 515 million tons in 1980, up 62 percent from 317 million tons in 1965, and compared with a 1,330 million-ton total projected for grain consumption. Western Europe and Japan are likely to remain the leading coarse grain importers. The EEC is expected to continue importing at least 13 million tons of coarse grain while Japan may double its imports to over 10 million tons. From net exporters of 5 million tons in 1965, the less developed countries as a group appear destined to become net importers of at least this amount, if present production policies continue. The United States is likely to continue to lead the world in net exports of coarse grain. Food is expected to account for 590 million tons and other uses, 225 million tons of grain in 1980. This projection is based on a cross-sectional analysis of the world grain and meat economy involving the following principal relationships: meat consumption, human grain consumption, and income per capita, grain-meat ratio, and proportion of grain fed to livestock. The projection employs explicit assumptions on demand and production for 23 regions of the world and analyzes trends for these regions.

Keywords: Feed grain, livestock products, livestock feeding, demand, world, projection, cross-section, time series, regression analysis, economic development, international trade.

FOREWORD

This study is part of a research project on Demand Prospects for Agricultural Exports of Less Developed Countries conducted by the Economic Research Service under a participating agency service agreement with the Agency for International Development. Research under this project was carried out in three phases: Phase A -- Historical analysis of agricultural exports of less-developed countries; Phase B -- Analysis of demand prospects for selected agricultural products in importing countries; and Phase C -- Analysis of policy implications of these estimated world demand prospects for export earnings from selected agricultural products in less-developed countries.

This report is one of a series publishing results of the research project on demand prospects for selected agricultural commodities. In addition to feed grains, these commodities include wheat, rice, cotton, oilseeds and products, coffee, cocoa, tea, bananas, citrus fruits, and selected vegetable crops. Published earlier were separate reports on international trade in these commodities and a report on their world demand prospects.

World consumption of feed grain has been increasing rapidly in recent years, especially in the developed countries, and is expected to continue at a rapid rate of growth over the next decade and a half. Rising levels of consumer income in many countries have stimulated and will continue to accelerate the demand for livestock products and, in turn, the demand for grain fed to livestock. This report deals specifically with a part of the total world grain economy -- feed grain -- and focuses particularly upon the world meat and livestock economy as a basis for deriving the world demand for feed grain. The demand potentials for feed grain are evaluated under alternative technical and economic conditions for the major regions of the world by 1980 and some of the implications of these demand prospects upon world production and trade are outlined.

Research on the demand prospects for agricultural exports of less developed countries was conducted under the direction of an ERS Technical Advisory Committee: Louis F. Herrmann, Chairman, and Arthur B. Mackie and Anthony S. Rojko, advisors and research leaders.



Acting Director,
Office of Agriculture and Fisheries
Agency for International Development

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SUMMARY

World grain consumption by livestock is expected to reach 515 million tons in 1980, up 62 percent from the 317 million tons estimated to have been fed to livestock in 1965, an increase averaging over 4 percent annually. This projection is one among several cases analyzed that yield estimates of 1980 world feed grain consumption ranging from 400 million to 600 million tons in accordance with alternative assumptions. If this projection is born out and if conditional trends of production materialize, Western Europe and Japan are expected to continue to lead the world in coarse grain imports. The European Community (EEC) is expected to continue importing at about the present rate of 13 million tons, though slight deviation from projected meat demand could cause EEC imports of coarse grain to double by 1980. Japan is likely to at least double its import of coarse grain to over 10 million tons.

From a net export position of 5 million tons in 1965, the less developed countries as a group appear destined to become net importers of at least this amount, if present per capita levels of meat consumption are not to be reduced. They would import even larger amounts if expected relationships to income growth hold and no change is made in present production policies in some less developed countries. Exports of some less developed countries (LDC's) are projected to increase, and the United States should continue through 1980 to lead the world in net exports of coarse grain.

These projections are based on analysis of the main sequence of events in the development of the world grain-livestock economy. By means of regression analysis, three basic world functions were generated: a consumption function for meat, a function for grain used as food, and a function for determining the input of grain per unit output of meat (grain-meat ratio) for countries at different stages of economic development. A world demand for grain fed to livestock was then derived by utilizing the function for grain-meat ratios and the demand for meat under assumed levels of self-sufficiency in meat production in all countries.

Apparently, a homogeneous world demand function exists for meat, since over 80 percent of the variation in meat consumption between countries was explained by the world demand function. The price elasticity of demand for meat was found to be -0.6, while the income elasticity of demand for meat was 0.65. Both elasticities were evaluated at the mean values of the variable and are consistent with values obtained from time-series data in selected countries.

Analysis of the grain-meat ratio indicates that more grain per unit of meat output is used in the developed world than in the developing world. Because the grain-meat ratio is low in the developing world, the important variant in grain use may be changes in this ratio. On the other hand, income as it affects meat consumption is the chief variant in the use of grains in the developed countries. The main sequence also suggests that the grain-meat ratio varies directly with meat consumption.

As expected, human grain consumption was systematically related to economic development as reflected by per capita income, with a negative income response for the developed countries and a positive response for the poorer of the less developed countries. In contrast, income-consumption responses for meat, though

varying, remained positive for all countries of the world. Coarse grains constitute about 90 percent of grain fed to livestock in all countries but represent a declining proportion of food grain, as countries pass through the various stages of economic growth.

Less developed countries are expected to feed their livestock 65 million tons of grain in 1980; central plan countries, 150 million tons; and developed countries, over 300 million tons. These figures imply more than doubling the use of feed grain in less developed countries, 65-percent expansion in central plan countries, and 51-percent growth in developed countries.

Food is expected to account for about 590 million tons of grain, with 305 million in less developed countries, 227 million in central plan countries, and 58 million in developed countries. This prospect for 1980 is the result of a 47-percent growth in less developed countries and a 27-percent expansion in central plan countries, offset by an 8-percent decline in developed countries. The 1980 consumption of coarse grain as food is expected to reach 166 million tons. The expected consumption of 96 million tons by less developed countries would be up 55 percent over the base period. The 60-million-ton consumption of central plan countries would be up 28 percent, while the developed countries' 9 million tons should change little. Other uses together may account for 225 million tons of grain in 1980.

The combined effect of food and feed consumption in all countries is to raise expected total grain consumption by 45 percent to about 1,330 million tons in 1980. This rise in grain consumption is closely associated with an expected rise in per capita meat consumption by 29 percent and world total meat consumption by 58 percent.

Less developed countries should find increasing outlets for coarse grains during the next decade both in the developed and within the less developed countries. Many LDC's are within the income range where the per capita demand for grain as food and feed is increasing. Combined with rapid population growth, this rising income results in significant expansion in grain requirements, part of which will be met by coarse grains. In addition, the demand for meat expands rapidly with economic development; if these countries are to increase livestock production to satisfy the growing demand, much larger quantities of grains will be needed for feed. These requirements in many less developed countries will significantly expand the demand for and the production of coarse grains, which would make production of grain a more promising alternative where ecological conditions are favorable.

The greatest absolute growth in coarse grain demand will occur in the developed countries. With expanding meat consumption and highly developed livestock production increasing grain requirement, the demand for feed grain should increase substantially. The total import demand in the developed countries is projected to continue to grow during the next decade despite support policies that artificially stimulate production in some countries. Several developed countries, including the United States, are efficient producers of coarse grains, with vast potential for further expansion, and these countries will continue to be active competitors in the world market. However, with a growing world market, less developed countries will have an opportunity to share in this growth if they can produce coarse grains at costs comparable to those in efficient exporting developed countries.

World Population, 1961



Figure 1

World Wheat Production, Average 1957-61



Figure 2

World Rice Production, Average 1957-61*



GUDRY, NELSON P. A GRAPHIC SUMMARY OF WORLD AGRICULTURE. U.S. DEPT. AGR., ECON. RES. SERV. MISC. PUB. 705 REV. SEPT. 1964.

Figure 3

World Corn Production, Average 1957-61



Figure 4

World Cattle Numbers, Average 1957-61*



Figure 5

World Hog Numbers, Average 1957-61



Figure 6

World Sheep Numbers, Average 1957-61



Figure 7

World Goat Numbers, Average 1957-61



Figure 8

Results of the project of which this report is a part have been published as follows by the Economic Research Service:

World Trade in Selected Agricultural Commodities, 1959-65

Vol. I.--Beverage Crops: Coffee, Cocoa, and Tea. Foreign Agr. Econ. Rpt. 42, June 1968.

Vol. II.--Food and Feed Grains: Wheat, Rice, Maize, Barley, and Other Cereals. Foreign Agr. Econ. Rpt. 45, June 1968.

Vol. III.--Textile Fibers: Cotton, Jute, and Other Vegetable Fibers. Foreign Agr. Econ. Rpt. 543, June 1968.

Vol. IV.--Sugar, Fruits, and Vegetables. Foreign Agr. Econ. Rpt. 44, June 1968.

Vol. V.--Oilseeds, Oil Nuts, and Animal and Vegetable Oils. Foreign Agr. Econ. Rpt. 47, Aug. 1968.

Japan's Food Demand and 1985 Grain Import Prospects. Foreign Agr. Econ. Rpt. 53, June 1969.

World Demand Prospects for Agricultural Exports of Less Developed Countries. Foreign Agr. Econ. Rpt. 60, June 1970.

Growth in World Demand for Feed Grains Related to Meat and Livestock Products and Human Consumption of Grain, 1980. Foreign Agr. Econ. Rpt. 63, June 1970.

World Demand Prospects for Wheat in 1980 with Emphasis on Trade by Less Developed Countries. Foreign Agr. Econ. Rpt. 62, June 1970.

Copies of these reports may be obtained upon request to the Division of Information, Office of Management Services, U.S. Department of Agriculture, Washington, D.C. 20250.

Additional reports are being developed on the following as part of the overall research project: World demand prospects in 1980 for rice; total grain; cotton; oilseed and meal; citrus fruits; coffee, tea, and cocoa; and bananas; the Japanese grain-livestock economy; and world agricultural import barriers. Publication of these reports will be announced.

GROWTH IN WORLD DEMAND FOR FEED GRAINS:

RELATED TO MEAT AND LIVESTOCK PRODUCTS AND HUMAN CONSUMPTION OF GRAIN, 1980

by

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INTRODUCTION

World exports of the major feed grains almost doubled during the first two-thirds of the past decade, rising from 22.3 million metric tons 2/ valued at about \$1.2 billion in fiscal year 1960, to 43.8 million tons worth nearly \$2.4 billion in the year ending June 30, 1966. 3/ These exports have since declined about 10 percent to an estimated 39.4 million tons for fiscal year 1969.

Nine countries -- the United States, Argentina, France, South Africa, Brazil, Canada, Mexico, Thailand, and Australia -- accounted for 80 to 88 percent of world feed grain exports during the decade. Although the United States has been and will probably continue to be the dominant international supplier of feed grains, the 1960's demonstrated the opportunities for other efficient producers to share in the growth in the market. Among the less developed countries, Argentina, long a major exporter, increased its exports from 4 million tons in 1960 to 5.6 million in 1969. Thailand enjoyed almost uninterrupted growth in exports, from 0.3 million tons in 1960 to 1.3 million in 1969. Although its support prices exceed international price levels, Mexico increased exports from 0.4 million tons in 1960 to about a million tons in 1969. Brazil started the decade with almost no exports and reached a high of nearly 1.2 million tons in 1969. Other less developed countries, located principally in East Africa and Southeast Asia, have exported significant quantities of feed grains in recent years.

What has happened during the past decade suggests that less developed countries can participate in the world feed grain market, and that where favorable technical and economic conditions exist, there is a potential for these countries to compete with other exporters and increase exchange earnings by exporting more feed grains. Opportunities for these less developed countries will be greatly affected by future trends in total import demand for feed grains. If the declining trend of 1966-69 continues, the prospects would be favorable, although the less developed countries, generally, did not fully

1/ The Historical Setting was prepared by O. H. Goolsby, the Main Sequence and the Projections were prepared by D. W. Regier.

2/ All tons referred to in this report are metric tons.

3/ Includes corn, sorghum, barley, and oats, excluding products.

share in the recent declines. If this short-term trend is reversed and the longer term expansion trend is reestablished, prospects would appear to be very bright.

The more developed countries of the world import the bulk of the feed grains. In these countries, increased affluence is stimulating a rapid rise in the demand for the generally preferred high-protein foods such as beef, pork, poultry, eggs, and dairy products. An increase in the consumption of a live-stock product normally causes a response in feed grain requirements that is much greater than the increase for the product itself. The less developed countries also are gradually upgrading consumer diets by using more animal products. The rates at which these changes take place in the future will determine the size of the feed grain market in the years ahead.

This report presents an historical and statistical analysis of the major determinants affecting the demand for feed grains. For each region, trade patterns are briefly discussed and the major factors affecting production and consumption are analyzed. The interrelationships between meat consumption, meat production, and feed grain use are examined. These interrelationships are used as a basis for considering future developments in the feed-livestock sectors of the regions of the world to develop projections of feed grain demand in 1980. The setting for the analysis and the projections is shown in the accompanying maps (figs. 1-8).

HISTORICAL SETTING

This review covers developments in feed grain trade, production, and consumption since the early 1950's. The developments during this period by and large explain present relationships, and these developments are the basis upon which projections must be made. Knowledge of some developments before this period is essential to understanding present relationships and those developments are discussed briefly. However, because of the great political and institutional changes made after World War II, emphasis is placed upon changes since that time.

Developed Countries

The developed nations were the major markets for feed grain moving in international trade in the 1950's and 1960's. Western Europe and Japan took 70 percent of the trade in 1951-53, and 80 percent in 1963-65 (table 1). Thus, the proportion imported by these nations increased, as well as the quantity. Clearly then, the developed nations represent a great potential market for feed grains. At the same time, the developed nations are the major exporters of feed grains, exporting approximately two-thirds of the world total in 1951-53 and 1963-65 (table 2). Obviously, the trends in these nations are of the utmost importance in ascertaining the potential foreign exchange earnings from feed grain exports by the less developed nations.

The European Economic Community

The European Economic Community (EEC), considered as one entity, is the world's largest feed grain importer, and during the 1950's and 1960's, its feed grain imports increased at a steady rate. Imports in 1963-65 averaged 14.3 million tons, over 40 percent of world trade. The less developed nations typically furnished 20 to 40 percent of this -- most of it by Latin America, chiefly Argentina (tables 3 and 4). In the early 1950's, North Africa and West Asia were fairly significant suppliers, but by the late 1960's the quantity and proportion imported from these areas had declined to low levels. Canada, likewise, was a fairly important supplier in the early 1950's but its importance slipped after 1953. Intra-Community trade was much more important in the 1960's than in the 1950's. The United States supplied more than half the Common Market's import requirements in every year except 1954.

Production changes. -- The area devoted to coarse grain production has not changed since the early 1950's. Most land suitable for grain production has been under cultivation for many years. Production, nevertheless, increased rather steadily and at a significant rate as a result of increases in yields. In 1951-53, yields averaged 1,980 kilograms per hectare; by 1966, they were 2,900 kilograms per hectare. Very large increase in yields in 1967 and 1968 brought yields to 3,390 kilograms per hectare by 1968.

These increases are the result of several factors. The aggregate use of mineral fertilizers in the EEC has increased significantly. Between 1955-57 (crop years) and 1966, the use of nitrogen increased 90 percent, phosphates, nearly 50 percent, and potash, 36 percent (all in terms of plant nutrients).

Table 1.--Feed grain imports by importing region,
averages 1951-53 and 1963-65

Importer	Quantity			Proportion of world imports	
	1951-53	1963-65	Percentage	1951-53	1963-65
	average	average	change	average	average
	-----	1,000 m.t.	-----	Percent	1/ -----
Developed countries:					
EEC	4,787	14,302	198.8	32.6	41.3
Other Western Europe ...	1,923	4,808	150.0	13.1	13.9
Japan	976	4,657	377.2	6.6	13.4
United Kingdom	2,771	4,150	49.8	18.8	12.0
Canada	154	373	142.2	1.0	1.1
United States	1,678	189	-88.7	11.4	.5
Australia, New Zealand, : and South Africa	99	2	-98.0	.7	---
Total	12,389	28,482	129.9	84.3	82.2
Central plan countries:					
Eastern Europe	740	3,113	320.7	5.0	9.0
USSR	---	---	---	---	---
Communist Asia	---	255	---	---	.7
Total	740	3,368	355.1	5.0	9.7
Less developed countries:					
Latin America	278	853	206.8	1.9	2.5
West Asia	141	663	370.2	1.0	1.9
Other East Asia	308	361	17.2	2.1	1.0
North Africa	54	307	468.5	.4	.9
Oceania	32	169	428.1	.2	.5
East Africa	126	159	26.2	.9	.5
South Asia	618	143	-76.9	4.2	.4
West Africa	25	109	336.0	.2	.3
Southeast Asia	---	16	---	---	---
Total	1,582	2,781	75.8	10.6	8.0
World total	14,705	34,632	135.5	100.0	100.0

1/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. of Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 2.--Feed grain exports by major exporters,
averages 1951-53 and 1963-65

Exporter	Quantity			Proportion of world imports	
	1951-53	1963-65	Percentage	1951-53	1963-65
	average	average	change	average	average
	1,000 m.t.			Percent ^{1/}	
Developed countries:					
United States	4,817	16,155	235.4	32.6	46.6
EEC	187	3,833	2/	1.3	11.1
Australia, New Zealand and South Africa	729	2,102	188.3	4.9	6.1
Canada	3,198	1,390	-56.5	21.7	4.1
Other Western Europe ...	313	541	72.8	2.1	1.6
United Kingdom	91	187	105.5	.6	.5
Japan	33	---	---	.2	---
Total	9,369	24,208	158.4	63.4	69.9
Central plan countries					
USSR	1,178	2,044	73.5	8.0	5.9
Eastern Europe	664	1,406	111.7	4.5	4.1
Communist Asia	280	151	-46.1	1.9	.4
Total	2,122	3,601	69.7	14.4	10.4
Less developed countries					
Latin America	1,419	4,767	235.9	9.6	13.8
Southeast Asia	61	964	2/	.4	2.8
West Asia	831	447	-46.2	5.6	1.3
North Africa	690	316	-54.2	4.7	.9
East Africa	99	142	43.4	.7	.4
West Africa	100	97	-3.0	.7	.3
South Asia	---	79	---	---	.2
Southeast Asia	11	9	-18.2	.1	---
Oceania	7	2	---	---	---
Total	3,218	6,822	137.2	22.2	19.7
Total world	14,709	34,631	135.5	100.0	100.0

^{1/} Percentages may not add to 100 due to rounding.

^{2/} Base too small to compute meaningful percentage change.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 3.--Feed grain imports by the EEC, by source of imports, 1951-65

Year	Total 1/	Developed nations					Central plan : nations					Less developed nations				
		: United:	: States:	: Canada:	: EEC	: EFTA:	: Australia,:	: New Zealand,:	: Eastern:	: Europe	: USSR	: Total 1/:	: America:	: Africa:	: Asia	: Latin : North : West
1951.....	4,560	2,717	1,958	482	45	37	178	133	176	1,398	670	348	286			
1952	5,166	3,033	1,290	983	107	385	243	354	120	1,651	818	423	280			
1953	4,635	2,545	1,307	634	160	222	188	119	108	1,839	757	485	571			
1954	6,147	1,749	756	107	157	213	501	163	126	4,109	2,646	602	726			
1955	5,402	3,352	2,121	191	257	210	573	86	23	1,934	1,121	379	273			
1956	8,088	4,795	2,852	103	466	501	867	244	222	2,823	1,573	555	474			
1957	6,948	4,222	1,865	161	1,263	207	721	62	345	2,316	1,774	171	256			
1958	7,770	4,358	2,752	60	336	435	775	432	105	2,861	2,106	306	288			
1959	8,822	5,745	4,196	116	256	321	849	195	136	2,701	2,044	260	206			
1960	9,901	5,706	3,953	160	627	363	603	476	174	3,504	3,181	181	51			
1961	9,376	6,490	3,750	60	1,671	314	690	641	279	1,966	1,828	50	3			
1962	13,434	9,085	6,274	143	851	650	1,163	550	287	3,512	2,901	54	386			
1963	13,082	9,174	6,170	353	1,226	320	1,101	509	173	3,226	2,845	131	164			
1964	13,277	8,981	6,192	260	1,781	267	476	586	34	3,676	3,398	115	106			
1965	16,548	11,881	8,351	281	2,341	538	359	443	244	3,980	3,801	50	125			

1/ For some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 4.--Percentage of feed grains imported from major sources by the EEC, 1951-65

Year	Developed nations					Central plan: nations					Less developed nations				
	Total 1/	United States	Canada	EEC	Australia, New Zealand, and South Africa	USSR	Europe	Total 1/	Latin America	North:West	Africa:Asia				
1951	100.0	59.6	42.9	10.6	1.0 .8	3.9	2.9	3.9	30.7	14.7	7.7	6.3			
1952	100.0	58.7	25.0	19.0	2.1 7.5	4.7	6.9	2.3	32.0	15.8	8.2	5.4			
1953	100.0	54.9	28.2	13.7	3.5 4.8	4.1	2.6	2.3	39.7	16.3	10.5	12.3			
1954	100.0	28.5	12.3	1.7	2.6 3.5	8.2	2.7	2.1	66.9	43.1	9.8	11.8			
1955	100.0	62.0	39.3	3.5	4.8 3.9	10.6	1.6	.4	35.8	20.7	7.0	5.1			
1956	100.0	59.3	35.3	1.3	5.8 6.2	10.7	3.0	2.7	34.9	19.4	6.9	5.9			
1957	100.0	60.8	26.8	2.3	18.2 3.0	10.4	.9	5.0	33.3	25.5	2.5	3.7			
1958	100.0	56.1	35.4	.8	4.3 5.6	10.0	5.6	1.4	36.8	27.1	3.9	3.7			
1959	100.0	65.1	47.6	1.3	2.9 3.6	9.6	2.2	1.5	30.6	23.2	2.9	2.3			
1960	100.0	57.6	39.9	1.6	6.3 3.7	6.1	4.8	1.8	35.4	32.1	1.8	.5			
1961	100.0	69.2	40.0	.6	17.8 3.4	7.4	6.8	3.0	21.0	19.5	.5	---			
1962	100.0	67.6	46.7	1.1	6.3 4.8	8.7	4.1	2.1	26.1	21.6	.4	2.9			
1963	100.0	70.1	47.2	2.7	9.4 2.4	8.4	3.9	1.3	24.7	21.7	1.0	1.3			
1964	100.0	67.6	46.6	2.0	13.4 2.0	3.6	4.4	.3	27.7	25.6	.9	.8			
1965	100.0	71.8	50.5	1.7	14.1 3.3	2.2	2.7	1.5	24.1	23.0	.3	.8			

1/ In some years based upon data that included regions not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

The member states of the EEC are quite actively involved in developing new and improved plant varieties. Improved strains of barley have been developed in France and Holland, and hybrid corn is being planted widely in Italy and France. Since total acreage in coarse grains in the EEC was relatively constant, the increases in acreage for barley and corn had to be matched by declines for other grains, primarily rye and oats. Despite small size of farms, mechanization in the EEC proceeded rapidly after 1950. Numbers of tractors and combines have more than quadrupled, and this increase in mechanization permits more timely planting and harvesting activities (15)*. All of these changes reflect a continued expansion of farms that are controlled by more progressive and better managers.

These improvements have occurred despite several drawbacks. Much of the land cultivated is not suitable for mechanization and would not be cultivated in the United States. Such land is being abandoned slowly or is reverting to permanent pasture. Farms are often small and sometimes fragmented, the result of several centuries of history. Significant changes in governmental policy are not likely to change EEC agriculture from its historical pattern and convert it to a modern economic entity. A fuller discussion of the effect of the Common Market's common agricultural policy on production (and consumption and trade) is given below.

Despite these obstacles, the substitution of capital for human effort has been large and is expected to continue at a rapid pace. Nevertheless, the end result is likely to be an agriculture that requires a relatively high price for farm goods to provide even low returns to the majority of the operators of small farms (25, pp. 62-3).

Consumption patterns. -- Total consumption of coarse grains rose at a rate of approximately 1.7 percent per annum between 1956 and 1967. Some uses of feed grains, however, increased more rapidly than others. By 1965-67, just over 5 percent was used for direct human consumption, over 81 percent for animal feed, and 13.5 percent for other uses. A decade earlier, the percentages were, respectively, 9 percent, 78 percent, and 13 percent.

Population increases contributed to increases in utilization but the effect was not large. Population growth rates in the Community during recent years have been substantially below those in the United States and many other regions of the world. The EEC recorded a 1.15-percent annual increase in population from 1960 to 1965, compared with a rate of 1.50 percent in the United States. The EEC growth rate has been decreasing in recent years, after a decline in net immigration. Since 1962, migration has not been a major factor in EEC population change and is not expected to be very important in the future. The rate of population increase will probably continue to decline.

Per capita use of coarse grain increased roughly 1.2 percent per year. As incomes in the Community have increased (4.5 percent per capita per annum) the demand for meat has increased and thereby, the demand for feed grains. Nearly all the increase resulted from more use of coarse grains as animal feed but some has resulted from increases in other uses. Direct human consumption has

*Numbers in parentheses in text and tables refer to items in references.

declined slightly. This pattern follows the pattern typical of areas with rising per capita incomes.

Several technical factors influence the use of coarse grains in the production of meat in the Common Market. Livestock production is widespread on farms and, by U.S. standards, is relatively small-scale. However, for poultry and egg production, a rapid expansion is occurring in large-scale commercial production on specialized farms. These farms are similar to those that dominate U.S. poultry and egg production. The European farms use the most advanced technology based upon purchased feed and thereby have increased the demand for feed grains.

The production of beef in the EEC is of special interest because of the potential demand for feed grains. So far, beef production in the EEC is primarily a joint product within the dairy industry. Some highly specialized dairy areas are found in the Netherlands and northwest France, but, in general, cattle that produce milk are found widely throughout the EEC. Typically, a farm has a few cows that are fed with the farm's permanent pasture or rotation forage supplemented with home-produced grains, or both. The calves are fed milk produced on the farm or, in some areas, milk substitutes, and many of these calves are sold as veal. Calves that are kept to older ages consume the farm-produced forage supplemented with home-grown grains, fodder beets, and, in some areas sugarbeet tops. These animals, together with the culled dairy cows, constitute the bulk of beef eaten by EEC consumers.

As yet, there is no appreciable development of specialized beef cow herds because the small fragmented farms prevent farmers from making an adequate living through production of beef calves on extensive pasture or range-type production units. One exception to this generalization occurs in the central mountain area of France, where the Charolais and Limousine breeds are found. These are fine beef breeds of cattle and their numbers are growing because farm size in this area allows the development of extensive cattle grazing. It is worth noting that until recently the cattle on many farms in the EEC were triple purpose -- draft, milk, and beef. Now the trend is toward dual purpose -- milk and beef; and where the single purpose cow is growing in numbers, it is the milk cow.

Beef cattle feeding as it has developed in the United States is not common. It is limited by the European preference for lean beef and the scarcity of suitable feeder calves. Where such feeder operations do occur, they are usually based on use of dual-purpose calves or limited numbers of beef-type calves. Given the farm structure of the EEC, beef production will probably be tied closely to dairy production for many years to come. Unless a source of low-cost feeder calves can be found, the development of an extensive feeder cattle industry that uses purchased feed seems unlikely. There are some of these enterprises in northern Italy that use calves from the East Bloc countries and imported feed. If the growing consumer demand for these calves in the exporting countries is to be met, it is uncertain whether these calves will be available at reasonable prices.

Improved feed conversion rates will tend to prevent grain requirements for each type of production from expanding at the same rate. On the other hand, there is likely to be a reduction in the proportion of nongrain feed in the

rations, particularly with respect to potatoes for hogs. Thus, substantial increases in grain requirements are expected for hogs and poultry but not for cattle (25, pp. 82-83).

The Common Agricultural Policy (CAP). -- The decline in feed grain imports from Canada, North Africa, and West Asia was not due to any explicit decision made by the Common Market countries to discriminate against these suppliers and favor other foreign suppliers. There was, of course, a degree of protection given to domestic farmers by each EEC country over all foreign producers before mid-1962, when the CAP was instituted. At that time, preference was given to member states of the Community over nonmembers by use of the variable levy system. From then until mid-1967, the preference was slight and may have been too small to break long established trade patterns and business connections. The period between mid-1962 and January 1, 1970, was to be a transitional period during which the agricultural prices in the various member states were to be brought gradually together. However, divergent national interests prevented any meaningful progress during the early years of this period. In December 1964, a decision was made to adopt unified prices to become effective July 1, 1967. The changes made at that time are likely to affect agricultural imports from non-member nations much more than the changes that took place in mid-1962.

In general, the adoption of the CAP resulted in the following changes that can affect agricultural imports: (1) Higher prices for feed grains in most member states under a price-support system intended to insure "adequate income" to farmers; (2) protection for Community farmers against competition from imports by use of a variable levy system that generally increases the prices of imports above those for domestically produced feed grain; (3) removal of nearly all trade barriers between member nations, which thus makes all markets equally accessible to all farmers within the Community; and (4) establishment of a Community-financed export-subsidy system that provides for subsidies at whatever levels would be required to sell products in world markets (4, p. iv).

Up until 1967, feed grain import requirements were growing rapidly, and no serious detrimental effects from the CAP were observed. In 1967 and 1968, production of feed grains was particularly high in the Common Market and imports dropped. Evidence is not sufficient, however, to conclude whether the increased production resulted from (1) high prices under the CAP, (2) good weather conditions, or (3) the adoption by farmers of technology that would have been adopted with or without high prices.

Exports. -- Not only is the Common Market the world's largest importer of feed grain, it is also the third largest exporter. Part of the reason is that intra-Community trade is counted in both the import and export totals. This trade is rather important. In several years, it was more than 50 percent of the total exports but, typically, it was 40 to 50 percent. By 1965, it was more than 2 million metric tons a year (tables 5 and 6).

Common Market exports have grown from 127,000 metric tons in 1961 to nearly 4.5 million in 1965. Growing proportionately with this total was intra-Community trade. Growing more than proportionately were exports to Spain and Switzerland from 1963 to 1965. The primary commodity exported is barley, and France is, by far, the largest exporter.

Table 5.--Feed grain exports by the EEC, by destination of exports, 1951-65

Year	Total 1/	Developed nations					Less developed nations
		Total 1/	EEC	EFTA	Other Western Europe	Eastern Europe	
1951	127	126	45	76	4	---	1
1952	216	209	107	102	---	6	1
1953	218	199	160	34	5	16	2
1954	401	379	157	222	---	18	3
1955	600	492	257	235	---	103	5
1956	956	685	466	219	---	271	---
1957	2,194	1,968	1,263	662	43	187	25
1958	639	638	336	292	6	---	1
1959	565	519	256	242	4	40	6
1960	1,276	1,266	627	627	12	---	10
1961	3,448	2,760	1,671	948	124	115	303
1962	1,839	1,549	851	695	3	129	33
1963	2,581	2,203	1,226	798	166	42	36
1964	4,429	3,784	1,781	1,231	737	463	19
1965	4,488	4,404	2,341	1,501	560	51	20
				1,000 m.t.			

1/ For some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Rpt. 45, Vol. II.

Without special financial assistance, exports of grains and grain products from the EEC to non-EEC nations would not be possible since domestic prices are far above world prices. Such assistance is provided under the Common Agricultural Policy in the form of export subsidies that are equal to the difference between world prices and EEC prices. The subsidies are uniform for the whole Community, but are differentiated according to country of destination. Thus, there is provision for setting subsidies high enough to make EEC grain competitive in any market in the world. Subsidized coarse grain exports did not present the less developed nations with a problem through 1965. However, indications are that these exports will be an important factor in the future.

Other Western Europe 4/

Source of grain imports. -- Although a diverse and scattered area, Other Western Europe is an important and rapidly growing market for coarse grains. Imports have varied between 1.6 million and 5.5 million metric tons between 1951-65. The trend on imports is upward at 222,000 metric tons per annum, roughly an annual growth rate of 7 percent. The developed nations supplied the majority of these imports, 60 to 80 percent, and the free less developed nations, a much smaller proportion, 10 to 20 percent. The central plan nations supplied the balance. The United States is, by far, the major supplier. After 1960, the EEC became a very significant supplier (tables 7 and 8).

Not only is the proportion of grain imports from the developed nations high, it is increasing. The trend on the market share for developed nations was upward at over 1 percentage point a year. Conversely, the market share for less developed nations is low and is declining; the trend is dropping by 0.6 percentage points per year. The quantity of imports from Latin America, the most important supplier of the less developed countries, was up but the market share declined nonetheless.

The major importers of grain in Other Western Europe are Denmark, Spain, Switzerland and Austria, with Spain as the most rapidly growing market. Sweden is the only country that is more than self-sufficient and is, therefore, a net exporter of feed grains -- mostly barley and oats. Denmark exports some barley but is still a net importer, and Portugal was a net exporter of corn until 1959. During the 1950's and 1960's, the trend on imports by Ireland and Sweden was downward, and for Denmark, imports declined in 1962-66 as it became more self-sufficient. Imports increased for the other nations for which there are data.

Production changes. -- Feed grain production increased nearly 200,000 metric tons a year on a trend basis during 1951-68 -- roughly, a little over 1 percent a year. There is, obviously, no one agricultural policy that governs production in all the various countries of Other Western Europe. On the contrary, each country has its own independent policy. Furthermore, climatic and soil conditions vary considerably, as do cultural practices. Reflecting the diversity of conditions, oat yields in Denmark equalled 108.6 bushels per acre in 1964, while the corresponding figure for Portugal was only 7.6.

4/ Includes: Austria, Cyprus, Denmark, Finland, Greece, Iceland, Ireland, Malta, Norway, Portugal, Spain, Sweden, and Switzerland.

Table 7.--Feed grain imports by Other Western Europe, by source of imports, 1951-65

Year	Developed nations					Central plan: nations		Less developed nations				
	Total 1/ —	United States 1/ —	Canada	EEC	Australia, New Zealand, and South Africa	Eastern Europe	USSR	Total 1/ —	Latin America	North Africa	West Asia	
1951	2,130	1,566	205	80	51	32	206	285	198	42	32	13
1952	2,010	1,226	301	79	14	181	199	404	311	12	44	40
1953	1,629	986	180	11	48	90	221	322	206	33	39	42
1954	2,274	1,018	77	165	104	173	128	929	691	54	100	134
1955	2,655	1,753	82	189	27	221	187	494	317	62	27	78
1956	2,654	1,711	88	122	18	233	310	393	214	35	22	121
1957	1,988	1,204	20	327	15	89	339	355	284	2	18	50
1958	2,651	1,578	82	105	7	203	179	691	472	58	67	71
1959	3,524	2,615	58	104	116	159	304	432	325	34	33	37
1960	3,300	2,240	44	327	70	323	227	466	387	38	32	9
1961	3,017	2,033	42	478	532	302	320	362	225	58	14	2
1962	3,589	2,401	32	238	48	209	254	725	410	15	47	248
1963	3,930	2,792	111	650	96	332	223	583	200	248	75	58
1964	4,921	3,911	93	1,565	51	242	24	744	409	188	75	72
1965	5,574	4,406	92	1,402	47	300	173	695	432	50	125	111

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 8.--Percentage of feed grains imported from major sources by Other Western Europe, 1951-65

Year	Developed nations					Central plan: nations		Less developed nations					
	Total	United States:	Canada:	EEC	Australia, New Zealand, and South Africa:	USSR: Eastern Europe:	Total	Latin America:	North Africa:	West Asia:			
1951	100.0	73.5	48.2	9.6	3.8	2.4	1.5	9.7	13.4	9.3	2.0	1.5	.6
1952	100.0	61.0	34.9	15.0	3.9	.7	9.0	9.9	20.1	15.5	.6	2.2	2.0
1953	100.0	60.5	32.3	11.1	.7	2.9	5.5	13.6	19.8	12.6	2.0	2.4	2.6
1954	100.0	44.8	13.3	3.4	7.3	4.6	7.6	5.6	40.9	30.4	2.4	4.4	5.9
1955	100.0	66.0	45.9	3.1	7.1	1.0	8.3	7.0	18.6	11.9	2.3	1.0	2.9
1956	100.0	64.5	48.3	3.3	2.3	.3	8.8	11.7	14.8	8.0	1.3	.8	4.6
1957	100.0	60.6	39.6	1.0	16.4	.8	4.5	17.1	17.9	14.3	.1	.9	2.5
1958	100.0	59.5	45.0	3.1	4.0	.3	7.7	6.8	26.1	17.8	2.2	2.5	2.7
1959	100.0	74.2	60.3	1.6	3.0	3.3	4.5	8.6	12.3	9.2	1.0	.9	1.0
1960	100.0	67.9	51.3	1.3	9.9	2.1	9.8	6.9	14.1	11.7	1.5	1.0	.3
1961	100.0	67.4	43.8	1.4	15.8	17.6	10.0	10.6	12.0	7.5	1.9	.5	.1
1962	100.0	66.9	53.7	.9	6.6	1.3	5.8	7.1	20.2	11.4	.4	1.3	6.9
1963	100.0	71.0	46.0	2.8	16.5	2.4	8.4	5.7	14.8	5.1	6.3	1.9	1.5
1964	100.0	79.5	42.3	1.9	31.8	1.0	4.9	.5	15.1	8.3	3.8	1.5	1.5
1965	100.0	79.0	47.6	1.7	25.2	.8	5.4	3.1	12.5	7.8	.9	2.2	2.0

1/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

One thought does predominate however. Incomes of farmers are not left entirely (or to any extent in some countries) to free market forces:

- (1) Agricultural imports are restricted through the use of quotas, levies, or tariffs, or
- (2) Incomes are supplemented by price-support programs of various sorts, or
- (3) Direct or indirect grants are given to farmers to offset cost of inputs, or
- (4) Some combination of the above three items occurs.

Barley is the major coarse grain in most of these Other Western European countries although oats are in Sweden and Finland and corn is in Portugal. Denmark is the major producer of coarse grains, followed by Spain and Sweden. Although Denmark and Spain are major producers they are, nonetheless, major importers. On the other hand, Sweden, as noted above, is self-sufficient in feed grains.

Changes in production in Denmark are of particular importance since the Danes produce roughly a fourth of the coarse grains in the Other Western Europe region. Since 1955, production increased in every year except 1959 and 1960; the growth rate was 3 percent annually. The area planted to barley increased 7 percent annually between 1955-57 and 1965-67. The area in rye, oats, and mixed grains declined, partially offsetting the increase for barley.

Danish agricultural policy traditionally was characterized by minimal government intervention. Agricultural prices were linked directly to export prices on the world market and, consequently, export prices depended upon the import policies of other countries. Since the late 1950's, the Danish agricultural industry has faced increasing import restrictions abroad and rising production cost at home. These developments reduced farm incomes at a time when nonfarm incomes were rising. To reduce the income gap, the Socialist Government in the late 1950's diverted from the laissez-faire policy of the past to the formulation of the first agricultural support programs.

Under the Bread Grain Scheme, part of the Grain Marketing Act of 1958, Danish grain producers were assured guaranteed minimum prices for their production (wheat and rye, plus storage allowances). The Scheme also stipulated the mixture of domestic grains to be used by millers. The guaranteed prices for bread grains were set at 49 kroner per 100 kilograms for wheat (\$70.00 per ton), and 47 kroner per 100 kilograms for rye (\$68.00 per ton), plus varying storage funds. These prices were maintained until the harvest year 1965/66.

The Grain Marketing Act did not restrict the quantity of bread grains marketed, and producers were entitled to receive the predetermined price when selling to a dealer or a mill. If more wheat and rye was produced than was used in domestic bread production, the Government arranged for the surplus to be used as feed and incurred the losses between the guaranteed price and the feed price for wheat and rye.

A support system for feed grain was also included in the Grain Marketing Act. Producer prices were set below those of wheat and rye. Minimum import prices were established, and variable levies brought import prices to this level. However, limited quantities of barley, barley products, oats, corn, and grain sorghum could be imported free of the variable levies. The minimum import prices established for feed grains in 1960-61 were \$53.00 per ton for oats, \$56.00 per ton for mixed grains, \$57.00 for barley and wheat and rye for feed, and \$57.00 for corn.

Modifications beginning in 1965-66 in the grain-support mechanism were due largely to the success of the previous policy in raising Danish production levels to near self-sufficiency. The milling ratio for domestic grains used in flour was raised to 100 percent. The change in this ratio precluded imports of bread grain, and resulted in relatively large quantities of wheat and rye being exported for feed at world market prices. Since 1966, there have also been seasonal import embargoes on barley, oats, and feed wheat and rye.

The Government discontinued guaranteed supports and storage allowances for bread grains with the 1965/66 crop. Instead, bread grains, like feed grains, are now supported by minimum import prices and a variable levy system. The levies are placed in a special "Grain Fund," supplemented by Government funds, and are used to make payments to small farmers to compensate them for feed costs.

The extreme importance of barley in the Danish grain economy lends added emphasis to recent developments in new barley variety experimentation. New varieties such as Emir were first marketed in Denmark in 1967. Emir is resistant against mildew and ripens early compared with other varieties such as Proctor and Pallas. Another variety, the Lofa, is widely used but has not been widely marketed. Expanded marketing of this variety was expected in 1969. The Lofa variety is resistant against mildew attack, but ripens rather late in contrast to the Emir variety. During the past 3 years, the mildew resistant varieties increased yields considerably compared with nonresistant varieties. Because winter barley is more prone to attack by mildew (and this characteristic has led to contamination of spring crops in the past), legislation was passed in 1968 that prohibits the growing of winter barley for 5 years.

Land in Denmark is intensively cropped, and only a small percent of total cultivated area is left fallow (about 3,000 hectares in 1966). The common rotation in Denmark is a 7- or 8-year rotation. On good soil, the rotation may be oats, wheat, root crops, barley, and grass with clover. Double cropping is not very widespread. Labor scarcity problems influence rotation patterns and have resulted in a shift out of root crops (such as potatoes, which require a relatively high labor input) and into grain.

Spain's primary crop is barley but, in addition, it produces substantial quantities of corn, rye, and oats. Total coarse grain production increased significantly -- 20 percent in the decade prior to 1965-67.

There were significant increases in grain yields between 1955-57 and 1965-67 in Spain due to increases in irrigated area, better farming practices, and use of better quality seed. However, the sharp rises in grain yields in both 1967 and 1968 are attributed primarily to very favorable weather.

Spain has become a surplus producer of wheat and is aiming at self-sufficiency in coarse grains to reduce import requirements. In the past 3 years, there has been increased emphasis on production of coarse grains and on reduction of wheat surpluses. The Government uses price-support programs, programs of financial assistance, market arrangements between producers and processors, and other programs to encourage production of grains.

Most coarse grains in Spain are still largely sown and harvested by hand. Wheat, although still largely sown by hand, has been mechanically harvested for many years (the emphasis on wheat production until 1965 promoted harvest mechanization). Greater use of fertilizer on nonirrigated land, on which most of Spain's grains are produced, is limited because of possible damage to crops in years of drought. However, some grain is grown on irrigated land, where rates of fertilization may be significantly increased. A high degree of farm fragmentation in the major corn producing areas of the north will handicap output expansion of this grain.

Oats are the primary coarse grain in Sweden, although barley production is growing rapidly. The area in barley production increased from about 240,000 acres in 1949-51 to a little over a million in 1962-64. During this same period, the area in oat production changed hardly at all. In the past, Sweden's agricultural policy was one of self-sufficiency. This policy led to farm subsidies and high food prices, reflecting high production cost. Government policy is shifting to one of lower levels of self-sustaining farm production, with food supplies supplemented by imports at a cost lower than Sweden's farmers could produce them. To streamline production and bolster income, the Government is encouraging farmers to (1) develop efficient production units, (2) supplement farming with other occupations, or (3) enter new occupations.

The other nations of Other Western Europe are not significant coarse grain producers. All, except Finland, are net importers of feed grains. In recent years, Austria and Spain have become more than self-sufficient in wheat; some wheat has been fed to livestock and, no doubt, more will be fed in the future. This situation will create pressures to shift acreage into coarse grain production and thus reduce imports. In general, there is a shift from oats and rye to barley and corn in Other Western Europe.

Consumption changes. -- Coarse grain use in this region increased without any serious disruption between 1951 and 1968. The increase, as measured by trend, was upward at over 600,000 metric tons or roughly 3 percent a year. Disappearance on a per capita basis is not extremely high but the trend is very strongly upward. The increase on a per capita basis was at an annual rate of 5.63 kilograms a year. Among the regions in this report, this trend was second only to that for Australia and New Zealand.

Incomes in the nations of Other Western Europe, even in the poorest country, are at a level where direct consumption of coarse grains responds very little to changes in income. All increases in coarse grain use are due to higher production and consumption of meat and greater uses for industrial purposes.

Since Denmark is the largest producer and importer of coarse grains, it is also the largest user. Total use averaged 5.3 million metric tons a year in Denmark in 1961-65 -- nearly all of which was used as livestock feed. The trend on total use was upward at 91,000 metric tons a year while meat production increased 38,000 metric tons annually. For Spain and Sweden, the second and third largest consumers in this region, the situation was similar, although meat production was not so large nor the increase in it so great. Use in Austria and Norway is not very great but the rate of increase (over 3 percent for each) is above the average for countries of this region.

The demand for coarse grains is largely determined by meat production, which, in turn, is determined by the demand for meat in the domestic and the international market. In the various domestic markets, increases in population were a very minor factor influencing coarse grain use. The average annual rate of growth was only .8 percent (table 9). Only in Iceland was the population growth rate as high as 2 percent. In Ireland, there was a decline in population. From the viewpoint of population, Spain represents, by far, the largest market, with nearly 32 million people in 1966, over 36 percent of the total in Other Western Europe.

With regard to income -- or, more precisely, consumer expenditures -- Spain is still the major market but it is closely followed by Sweden and Switzerland. In Spain, incomes grew 5.6 percent per annum in real terms between 1950 and 1965. Pig and poultry meat production and consumption grew dramatically in Spain after 1960, siphoning off some part of the increase in income. Matching these increases were increases in coarse grain imports. The trend was a 55,000 metric-ton-increase per year, and in 1964, Spain was the largest importer in Other Western Europe. Since Spain has reached self-sufficiency in wheat and rice, some acreage in the future will be transferred to feed grain production to reduce the need for imports. Already, some wheat is being fed to livestock.

Consumer expenditures in Sweden and Switzerland did not increase at a high rate in 1959-65, but the standard of living in these two countries was already quite high. Meat consumption on a per capita basis increased hardly at all for Sweden during this period. Thus, considering use only, there was no pressure to increase feed grain imports. In Switzerland, there was no dramatic increase in meat consumption, but there was a steady increase over the years that became quite significant on a cumulative basis. Offsetting this pressure to increase imports, a milk surplus developed in Switzerland. As a result, it has become Government policy to reduce milk herds, which, in turn, will reduce the need to import feed grains.

Greece was the country with the highest rate of increase (6.1 percent) in consumer expenditures in this region, and Greek consumption of meat, poultry, and eggs increased fairly significantly. Meat production and coarse grain imports increased also. However, some of the increase in the meat supply was met by imports, which, of course reduces the need to import feed grains. Austria was another country with a high rate of increase in consumer expenditures, 5.4 percent. Meat consumption increased about 2.8 percent per annum, mostly beef, pork, and poultry meat. A good proportion of the poultry consumed came from imports, however. Austria now has a milk and wheat surplus, and

Table 9.--Indicators of market potential for coarse grains
in Other Western Europe, by country, selected years

Country	Population		Consumer expenditures <u>1/</u>		Coarse grain imports	
	1966	Annual	1965	Annual	3-year average <u>2/</u>	Trend coefficient
		growth		growth		
		rate : :1950-65		rate : :1950-65		
	Million	Percent	Billion dollars	Percent	----- 1,000 m.t. -----	
Austria	7.3	.3	4.6	5.4	681	17.2
Denmark	4.8	.7	4.8	3.4	894	20.5
Finland	4.6	.9	2.9	3.4	n.a.	n.a.
Greece	8.6	.8	3.5	6.1	134	13.2
Iceland .....	.2	2.0	.1	4.2	n.a.	n.a.
Ireland	2.9	-.2	1.6	1.8	150	-9.3
Malta .....	.3	-.2	n.a.	n.a.	n.a.	n.a.
Norway	3.8	.9	3.1	3.1	228	4.6
Portugal	9.3	.6	2.4	4.7	99	3.7
Spain	31.9	.8	9.8	5.6	831	55.4
Sweden	7.8	.7	8.7	3.4	72	-8.9
Switzerland	6.0	1.6	6.9	3.7	694	17.9
Total	87.5	.8	48.4	4.3	---	---

1/ In 1958 dollars.

2/ Period varies, but in all cases most recent available data -- usually 1964-66.

Note: n.a. means not available.

Government policy is to induce a shift from milk to beef cattle. This policy will be a force tending to increase coarse grain use and, perhaps, imports. On the other hand, the wheat surplus has created pressures to shift wheat acreage into coarse grain production and to feed wheat to cattle, which thus reduces the need to import feed grains.

There are factors other than population and income that influenced a country's need to import feed grain. In Spain, there are many tourists and they represent a large demand for high quality foods, including meat. Furthermore, the number of tourists is increasing rapidly. In Spain, for example, there were 7.4 million tourists in 1961 and 17 million by 1966. Devaluation of Spanish currency in November 1967 has, no doubt, increased the number of tourists visiting Spain. The devaluation, however, will make imports more expensive for the local population and thus have a reducing influence on imports. Portugal met most of its increase in meat demand with imports. Meat production remained almost static although poultry production may now have reached a point of acceleration.

Demand for meat in the international market is also a very strong factor that influences the level of coarse grain imports by Denmark and Ireland. Denmark in 1961-65 exported an average of 750,000 metric tons of meat, mostly pork and mostly to the United Kingdom and the Common Market. The Irish exported about half as much (347,000 metric tons), most of it to the United Kingdom.

Danish exports to the Common Market -- primarily Germany -- of eggs, poultry, and live cattle were lower as a result of the EEC's Common Agricultural Policy (CAP). The market in the United Kingdom for Danish goods is under pressure because of British balance-of-payments problems. Few restrictions were placed on food imports, but the British Government undertook policies to lessen the rate of increase in incomes. These policies, no doubt, had some negative effect on meat consumption.

Irish exports to the United Kingdom were subject to many of the same pressures that Danish exports were. However, a trade agreement between the Governments of the United Kingdom and Ireland was signed late in 1965. The agreement is expected to boost Irish agricultural exports, especially meat, to the United Kingdom.

Japan

Trade patterns. -- After 1960, imports of coarse grains by Japan accelerated at such a rate that by the late 1960's, Japan was importing more coarse grains than any other country in the world. Even before 1960, it was an important importer. In some years, a substantial proportion came from less developed nations -- as much as 65 percent in 1960 (tables 10 and 11). However, the vast majority of Japanese imports came from highly developed nations, mostly the United States. Nevertheless, the trend is toward importing more from less developed nations, primarily Thailand and other Southeast Asian nations.

Table 10.--Feed grains imported from major sources by Japan, 1951-65

Year	Total 1/	Developed nations				Communist Asia	Less developed nations		
		Total 1/	United States	Canada	Australia, New Zealand, and South Africa		Total 1/	Latin America	Southeast Asia
<hr/>									
1,000 m.t.									
<hr/>									
1951	1,023	956	720	124	111	---	67	5	6
1952	1,011	893	346	473	74	---	118	35	---
1953	895	876	375	279	222	---	19	---	16
1954	976	856	295	333	219	---	120	83	29
1955	1,019	924	605	104	215	---	95	4	70
<hr/>									
1956	1,307	1,143	564	221	358	4	160	31	114
1957	1,371	1,241	443	273	525	10	120	14	98
1958	1,384	1,076	777	147	152	---	308	136	124
1959	1,430	941	493	115	333	---	474	270	142
1960	1,402	487	228	2	257	2	898	441	415
<hr/>									
1961	2,100	1,230	762	18	450	3	788	286	479
1962	2,732	2,326	1,428	5	893	13	360	53	243
1963	3,589	2,760	1,921	40	786	---	622	121	435
1964	4,756	3,458	2,621	85	752	180	1,076	250	750
1965	5,626	4,314	3,858	249	207	253	1,017	402	611

1/ For some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 11.--Percentage of feed grains imported from major sources by Japan, 1951-65

Year	Developed nations										Less developed nations			
	Total 1/	Total 1/	United States	Canada	Australia, New Zealand, and South Africa	Communist Asia	Total 1/	Latin America	Southeast Asia					
1951	100.0	93.4	70.4	12.1	10.9	---	6.5	.5	.6					
1952	100.0	88.3	34.2	46.8	7.3	---	11.7	3.5	---					
1953	100.0	97.4	41.7	31.0	24.7	---	2.1	---	1.8					
1954	100.0	87.7	30.2	34.1	22.4	---	12.3	8.5	3.0					
1955	100.0	90.7	59.4	10.2	21.1	---	9.3	.4	6.9					
1956	100.0	87.5	43.2	16.9	27.4	.3	12.2	2.4	8.7					
1957	100.0	90.5	32.3	19.9	38.3	.7	8.7	1.0	7.1					
1958	100.0	77.7	56.1	10.6	11.0	---	22.3	9.8	9.0					
1959	100.0	65.8	34.5	8.0	23.3	---	33.1	18.9	2.7					
1960	100.0	34.7	16.3	.1	18.3	.1	64.1	31.5	29.6					
1961	100.0	58.6	36.3	.9	21.4	.1	37.5	13.6	22.8					
1962	100.0	85.1	52.3	.2	32.7	.5	13.2	1.9	8.9					
1963	100.0	76.9	53.5	1.1	21.9	---	17.3	3.4	12.1					
1964	100.0	72.7	55.1	1.8	15.8	3.8	22.6	5.3	15.8					
1965	100.0	76.7	68.6	4.4	3.7	4.5	18.1	7.1	10.9					

1/ For some years based upon data that included areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Although the United States was the major supplier between 1951 and 1965, the proportion obtained from this country varied considerably -- between 16 percent (1960) and 70 percent (1951). A high degree of instability also characterizes the market shares of other sources.

Production changes. -- Japan is the only region of the 22 delineated in this report that has a declining trend on coarse grain production. The trend is due to a decline in acreage. Between 1955-57 and 1965-67, coarse grain areas declined by three-fourths while yields of most grains increased roughly 15 percent; for corn, yields increased 37 percent (15, p. 30). The current policy of the Government of Japan is to encourage selective expansion of agricultural production with due consideration given to changing demands. Particular emphasis is being placed on the production of fruits, vegetables, rice, and livestock products.

To aid the development of the livestock industry, Japan has followed a policy since World War II of maintaining a stable supply of feed to farmers. Almost all feed grains are imported free from duties or, if there are duties, under a low tariff; thus, prices are kept relatively low. This policy, plus the limited factors of agricultural production, permits only low returns on the production of corn, grain sorghum, and several other commodities. As a consequence, domestic production has declined since 1960 (11).

As is well known, the geography of Japan severely limits the land area for cultivation. The large population currently gives the country only 0.06 hectares of cropland per capita -- less than in Switzerland, Taiwan, the Netherlands, or Belgium. Arable land area can be and has been expanded through reclamation at substantial cost. The area reclaimed recently, however, has been offset by the area taken out of cultivation for urban and other use.

Nevertheless, it is not the total land constraint or urban use that accounts for the declines in production. Traditionally, double cropping -- largely with winter crops -- in effect has added land to production. Also, the land-saving, labor-intensive production technology had compensated for the total area constraint. Feed grains and some other crops face lessening profit possibilities because of problems concerning labor, capital, technology, enterprise scale, and other matters rather than the available land area.

As an illustration, double cropping declined as labor was attracted to other employment. Some workers migrated permanently to urban jobs, others, just for the winter, while some worked at farming only part-time the year around. Selective farm labor shortages began to appear. The total agricultural labor force (including part-time workers) declined steadily from 19.5 million in 1955 to 15.2 million in 1965. Since the number judged to be part-time and seasonal workers remained roughly stable at about 5.2 million, most of the decline occurred in farm managers and full-time workers, from 14.3 million in 1955 to 10.0 million in 1965. Consequently, it is not surprising that some withdrawal of land production accompanied labor withdrawals.

The total area planted to crops in Japan reached its postwar peak of 8.2 million hectares in 1956 and has declined downward since then. In 1965, the planted area was 0.9 million hectares less than in 1956, a fall of over 10 percent, the result of steady declines each year except 1960. The fall is due mainly to a decrease in double cropping, since the total land surface devoted to crops (not counting the second crop) remained about the same. The area planted each year as a percentage of total cropland fell steadily, from 144 percent in 1956 to 129 percent in 1965, indicating a decline in double cropping. This decline reflects the smaller area planted each year to second crops such as barley. The area planted to rice, the major summer crop, was approximately stable (3).

As stated above, increased production from higher yields has offset some of the decline that was due to the smaller area devoted to coarse grain production. Use of fertilizer (pure plant nutrients) in Japan has expanded at a rapid rate. Between 1950 and 1965, the use of nitrogen increased by two-thirds, phosphate doubled, and potash increased more than fivefold. Also, farm power equipment is increasingly being used in Japan. Use of these items helps to cut labor requirements, expedite harvesting, and intensify land use (15, p. 31).

Consumption changes. -- According to Barse, changes in consumption patterns in Japan are dependent, to an unusually high degree, upon Government policy. Consideration is given to changes in prices, income, and taste, but these play only an indirect part. The Japanese Government in the late 1950's faced a chronic food shortage that was distinct from the temporary food crises of the war and postwar years. The problem threatened to worsen because it mirrored deep-seated economic strains. The continuing tension between growing food demand and a lagging food supply could lead to severe, recurring economic difficulties.

Japanese per capita food consumption for 1957-59 was substantially lower than in several Western countries, whose per capita incomes approximated Japan's for those years. The typical Japanese consumer was not eating nearly as much as could be reasonably expected, given his relatively high income. Average Portuguese and Japanese consumers had personal incomes of about \$200 and \$210, respectively, in 1957-59. Yet, the Portuguese consumed about 2,650 calories per person per day while the Japanese, at 2,250 calories, barely exceeded the intake of the average Burmese, whose income was only about \$50 per year. Measured against Portuguese consumption, Japan's income-energy gap stood at about 400 calories per capita per day during these years. However, measured against Greek consumption, the gap stood at 850 calories. By any measure, a big difference existed between Japanese and Western consumption levels.

The income-energy gap cannot be attributed to any lag in Japan's per capita consumption of staple, starchy foods (cereals, sugar, and potatoes), since Japanese daily per capita consumption of these foods matched or exceeded Western levels. The gap is chiefly due to Japan's relatively low consumption of livestock products.

Any attempt to increase meat production by first boosting the output of traditional field crops surely would have been doomed. As stated above, greater output from expansion in the cultivated land area or in increased

yields was not feasible. Japan was already near its cropland ceiling, and, with the small scale of production, greatly increased amounts of capital and much more advanced technologies could not be employed economically in field crops. Thus, during the 6 years 1957-62, Japan undertook important policy decisions that, by the end of the period, added up to a new food strategy. Among other things, the policy was to control but greatly increase imports of corn and grain sorghum and to aid the development of the domestic livestock industry. This turn of events was the result of a conscious decision on the part of the Japanese Government. However, the situation may well be what would have occurred had the allocation of resource been left to free market forces (3).

As a result of these and other changes, feed grain use in Japan increased from roughly 4 million metric tons in 1957-59 to roughly 6.5 million metric tons in 1965-66. On a per capita basis, the trend is upward at a fairly high rate (over 2 percent annually). Nevertheless, consumption is still quite low by Western standards. In 1965, direct and indirect consumption was only 12 percent of that in the United States. Japan in the late 1960's is nowhere near being a saturated market.

Reasons for changes in origin of imports. -- Weather, economics, and Government policies have all played a role in Japan's changing trade patterns. The presence or absence of rain has been a major problem in determining whether corn was available for exporting from the Republic of South Africa. This consideration has no long-term effects, of course, but can decrease the quantity the Japanese imports from this source for several years.

Japan has run a consistent export surplus with many of the countries of Southeast Asia. To bring this trade more nearly into balance, the Japanese have made it national policy to import more from them, especially corn. With the open backing of the Japanese Government, various trading firms in Japan have committed themselves, through one means or another, to the purchase of certain amounts of corn from Southeast Asia. These arrangements are discussed briefly below in the section on Southeast Asia. In effect, the Japanese Government, through the trading firms, is establishing preferential import allocations for corn from the countries involved.

Matching the desire to balance trade with Southeastern countries is the desire to be less dependent upon one source of farm products; that is, the United States. The Japanese believe that a more diversified source of food supply is necessary to secure a stabilized food supply.

These attitudes, policies, and institutions have only recently come into being. While the import market share for the United States has fluctuated through 1965, there was no long-term trend against the United States. As time passes, however, it seems likely that the export opportunities for less developed nations will increase rapidly, particularly for those in Southeast Asia.

United Kingdom

Trade patterns. -- From 1951-57, feed grain imports by the United Kingdom ranged from 2.5 million to 3.0 million metric tons. In 1958, these imports jumped to 4.4 million metric tons and remained above 4 million metric tons from then until 1965. Less-developed nations did not share in this growth, however. Both the quantity and the proportion imported from these nations declined (tables 12 and 13). Latin America more or less held its own, but there were large declines for North Africa and West Asia. The United States was the largest source after 1953 and supplied almost 60 percent of the market in some years. Canada's share of the market generally declined after 1955, while that for Australia, New Zealand, and South Africa showed no strong trend.

Production changes. -- After cropyear 1959, feed grain production in the United Kingdom increased sharply. All of the increase was in barley production. In 1955-57, output of barley was only 2.9 million tons; by 1965-67, production was 8.8 million tons. This represents an average annual increase of roughly 20 percent. On the other hand, production of rye, oats, and mixed grain declined. Because of its cool climate, the United Kingdom does not produce corn, although experimental work is being done to develop a variety of suitable corn. The acreage devoted to barley production increased substantially -- from 977,000 hectares in 1955-57 to 2.4 million hectares in 1965-67, or by approximately 142 percent. Most of this increase was at the expense of wheat acreage.

The expansion for barley was partially caused by the deficiency payment system in the United Kingdom. Under this system, to qualify for a wheat deficiency payment, the crop must be sold off the farm, and the amount of the payment is related to actual yield. For coarse grains, the system does not require marketing of the grain. The amount of payment is based on estimated yields and acreage rather than actual production, since a large portion of coarse grains is not sold but is used on the farm as feed. The more liberal system for coarse grains has undoubtedly provided some incentive for increased barley production.

As the demand for both rye and oats declined, the acreage devoted to these two crops declined. Between 1955-57 and 1965-67, the area planted to oats declined nearly 61 percent to 396,000 hectares; mixed grains declined nearly 81 percent to 32,000 hectares; and rye fell 44 percent to only 5,000 hectares.

Grain yields in the United Kingdom showed steady rates of increase. Between 1950-52 and 1965-67, barley yields increased by nearly one-half, rye and oat yields increased by approximately two-fifths, while mixed grain yields increased by one-third. Rapid yield improvement for barley undoubtedly promoted an expansion of the area planted in this crop.

The enactment of agricultural policies designed to stimulate domestic production has been a significant factor in increasing agricultural production in the United Kingdom. The British experience during World War II stressed the danger of relying on imports for food supplies. Accordingly, since that time, the British have consistently stressed increased self-sufficiency as the principal goal of their agricultural policy.

Table 12.--Feed grains imported from major sources by the United Kingdom, 1951-65

Year	Developed nations						Central plan nations		Less developed nations					
	Total 1/	United States	Canada	EEC	Australia, New Zealand, and South Africa	Total 1/	Eastern Europe	USSR	Total 1/	Latin America	North:West	South:East		
1951	2,455	922	559	134	0	206	910	97	768	623	89	260	244	
1952	2,797	1,183	828	47	23	263	900	160	721	714	172	328	310	
1953	3,062	1,783	773	666	28	278	170	57	116	1,109	666	126	274	
1954	2,437	1,805	808	628	57	270	66	47	19	601	507	41	49	
1955	2,889	2,633	1,444	908	46	232	56	45	11	200	112	9	21	
1956	2,827	2,546	1,351	706	97	386	61	49	12	220	147	7	19	
1957	2,800	2,665	1,500	515	378	262	8	0	8	127	37	7	32	
1958	4,371	3,673	1,892	1,069	193	512	253	253	0	445	157	13	83	
1959	4,760	4,286	2,746	915	142	464	74	61	5	400	322	18	3	
1960	4,162	3,859	2,455	700	312	371	173	117	30	431	339	63	1	
1961	4,565	3,526	2,091	207	594	133	719	231	488	320	218	17	3	
1962	5,728	4,961	3,376	454	460	659	292	194	98	475	272	7	6	
1963	4,212	3,720	2,068	462	314	744	168	168	0	324	218	9	12	
1964	4,127	3,792	2,043	526	403	815	145	145	0	190	166	10	1	
1965	4,112	3,668	2,161	466	659	375	146	146	0	298	260	11	1	

1/ In some years includes data for regions not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 13.--Percentage of feed grains imported from major sources by the United Kingdom, 1951-65

Year	Total 1/	Developed nations				Central plan nations				Less developed nations			
		United States	Canada	Australia, New Zealand, and South Africa	EEC	Total 1/	USSR	Eastern Europe	Total 1/	Latin America	North Africa	West Asia	
1951	100.0	37.6	22.8	5.6	.0	8.4	37.1	4.0	31.2	25.4	3.6	10.6	9.9
1952	100.0	42.3	29.6	1.7	.8	9.4	32.2	5.7	25.6	25.5	6.1	11.7	11.1
1953	100.0	58.2	25.2	21.8	.9	9.1	5.6	1.9	3.8	36.2	21.8	4.1	8.9
1954	100.0	72.9	32.7	25.4	2.3	10.9	2.7	1.9	.8	24.3	20.5	1.7	1.8
1955	100.0	91.1	50.0	31.4	1.6	8.0	1.9	1.6	.4	6.9	3.9	.3	.7
1956	100.0	90.0	47.8	25.0	3.4	13.7	2.2	1.7	.4	7.8	5.2	.2	.6
1957	100.0	95.2	53.6	18.4	13.4	9.4	.3	.0	.3	4.5	1.3	.4	1.1
1958	100.0	84.0	43.3	24.4	4.4	11.7	5.9	5.9	.0	10.2	5.9	.3	1.9
1959	100.0	90.0	57.7	19.2	3.0	9.7	1.6	1.3	.1	8.4	6.8	.4	.1
1960	100.0	92.7	59.0	16.8	7.5	8.9	4.2	2.8	.7	10.4	8.1	1.5	3/
1961	100.0	77.2	45.8	4.5	13.0	2.9	15.7	5.1	10.7	7.0	4.7	.4	.1
1962	100.0	86.6	59.0	7.9	8.0	11.4	5.1	3.9	1.7	8.3	4.7	.1	.1
1963	100.0	88.3	49.1	11.0	7.5	17.7	4.0	4.0	0	7.7	5.2	.2	.3
1964	100.0	91.9	49.5	12.7	9.8	19.7	3.6	3.6	0	4.6	4.0	.2	3/
1965	100.0	89.0	52.4	11.3	16.0	9.1	3.5	3.5	0	7.2	6.3	.3	3/

1/ In some years includes data for regions not shown separately.

2/ Percentages may not add to 100 due to rounding.

3/ Less than .05 percent.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Grain production has been encouraged primarily through a deficiency payment system under which the Government pays the farmer the difference between the market price and a Government-supported minimum price. In 1966-68, this difference averaged 12-15 percent of total returns for each metric ton of barley and 22-27 percent for oats.

The amount of deficiency payment to be authorized is determined annually at a meeting between representatives of Government and the National Farmer's Union. According to the provisions of the Agriculture Act of 1957, the guaranteed price established for any given commodity cannot be less than 96 percent of the previous year's guaranteed price. The aggregate value of all price guarantees and production grants (discussed later) cannot be less than 97.5 percent of the previous year's aggregate value, with allowance for changes in the cost of production. Both of these requirements give an element of stability to the price-support program.

In 1964, the British Government announced its intention to limit its price-support policy by specifying standard quantities for wheat and barley, with only that portion of production not exceeding the standard quantity as eligible for deficiency payments. As the quantities selected were high relative to past production, this action did not restrict domestic production. Before the introduction of standard quantities, the record production of wheat was 3.9 million tons harvested in 1962, and the record barley crop was 6.5 million tons recorded in 1963. Combined, the largest United Kingdom production of both grains was 9.7 million tons in 1962. In comparison, the standard quantities selected for the first year were 3.3 million for wheat and 6.5 million for barley, making a combined total of 9.8 million tons. Further, at the 1968 Annual Review, the standard quantity for wheat was abolished, and the standard quantity for barley was raised to 8.6 million tons.

Also in 1964, the United Kingdom began placing restrictions on imports of grain. To protect British farmers from foreign competition, minimum import prices were introduced, and since then, grain imports have fallen short of the average level achieved during the 3-year period prior to the introduction of this policy.

Another important aspect of British agricultural policy has been the payment of farm grants and subsidies to those farmers willing to adopt advanced farming practices. Under legislative authority, payments have been made to farmers for such activities as fertilizer and lime application, plowing up of grassland, drainage, and farm improvement.

One of the most important technical advances experienced in the United Kingdom, with regard to agriculture, was the increased use of commercial fertilizers. Total consumption of all commercial fertilizers in terms of plant nutrient rose from nearly 1 million tons in 1955/56 to over 1.5 million tons in 1965/66. The most significant increase was recorded in use of nitrogenous fertilizers, which advanced 133 percent. Use of potash rose 40 percent, while consumption of phosphates grew only 7 percent. On a per hectare basis, application was 55.6 kilograms for nitrogen, 35.2 kilograms for potash, and 33.7 for phosphate in crop year 1966. It is estimated that subsidies to farmers purchasing nitrogenous and phosphatic fertilizers will cost the British Government \$87.1 million in 1967/68 alone.

Despite the rise in consumption of commercial fertilizers, the United Kingdom still ranks well below many other West European countries as a user of commercial fertilizer. Consequently, in the immediate future, use should continue to grow and to have a favorable impact on yields.

In the last two decades, plant breeders in the United Kingdom provided British farmers with improved strains and varieties of plants. These plants were capable of higher yields, were resistant to diseases, would stand, and would give rewards for very heavy applications of fertilizers. At the same time, seed growers have made considerable progress in expanding the output of "field approved" and "certified seed."

Such seed is produced under voluntary programs, supervised by the National Institute of Agricultural Botany (NIAB). These programs are all based on the same principle. Foundation or seed stock from the breeder or his agent forms the basis for all multiplication. Seed crops are inspected in the field and must conform to certain specified standards. When the program ends at the crop inspection stage, the seed produced is called "field approved." For many of the more valuable varieties, it is well worthwhile to supervise the seed through to the final cleaning. When this is done, the seed becomes "certified."

The main effort with grains -- wheat, barley, and oats -- has been development of the Cereal Field Approval Scheme. This has received particularly strong support from the seed trade, and has expanded steadily since its beginning in 1947, when some 15,000 hectares were inspected. By 1960, the area inspected had increased to about 66,000 hectares; seed grain on 29 percent of this area was rejected in the field. In the 1960/61 growing season, about 40 percent of the seed wheat and about 30 percent of the seed barley bought by farmers was field-approved.

There is practically no fragmentation of farms in the United Kingdom. Also, farms are larger, on the average, than those in continental Europe. As table 14 indicates, approximately 36 percent of the farms in the United Kingdom are at least 50 acres in size (excluding farms of 1 acre or less). The percent of total farmland in farms of 50 or more acres is estimated to be even higher. This size compares favorably with the situation in Other Western European nations. In the EEC, for example, less than 1 percent of farms consist of more than 40 acres, while about 47 percent of all farms are less than 2 acres.

Table 14.--Number of farms by size of holding, United Kingdom

Acres 1/	:	Farms	
		No.	Pct.
1 to 4	:	87,606	19.3
5 to 14	:	91,895	20.2
15 to 49	:	111,379	24.5
50 to 99	:	71,920	15.8
100 and over	:	91,726	20.2
Total	:	454,526	100.0

1/ Farms less than 1 acre not included.

The relatively favorable size of farms in the United Kingdom can be attributed to: (1) "historical accident," or more specifically, British inheritance laws, (2) adoption of free trade policy at a time when farmers did not have the power to resist it, and (3) simultaneous growth of industry and accompanying job opportunities for those displaced from the land. In other European countries, political revolutions gave power to the peasant class, which made displacement of these people more difficult. This difficulty, in turn, made possible the adoption of agricultural protectionism and the preservation of an out-of-date agricultural structure (19). Relatively large farm units are normally an important prerequisite for increasing production. For various economic reasons, they permit the adoption of more advanced agricultural techniques.

Changes in consumption. -- As indicated in table 15, the use of coarse grains for food consumption declined even though it was never very significant. On the other hand, coarse grains fed to livestock increased, on a trend basis, 166,000 metric tons annually from 1955/56 to 1966/67 -- roughly an annual average growth rate of 1.9 percent.

Barley, corn, and oats, in that order, are the most important feed grains in the United Kingdom. Barley and oats are produced domestically, of course, but all corn must be imported.

For part of the period under discussion, domestic production of coarse grains was unable to keep pace with rising requirements, and dependency on imports grew. However, during the period 1960/61-1966/67, domestic output increased by almost 50 percent, and the percentage of coarse grains used for feed that was provided by domestic production also grew. In 1958/59, for example, production equaled just under 70 percent of the quantity of coarse grains fed to animals. By 1965/66, this figure had increased to 95 percent.

Demand for coarse grains for other uses (that is, seed and industrial use, waste, and so on), although small, has also been increasing. The trend was upward at 60,000 metric tons a year, which is an approximate growth rate of 2.5 percent.

Population has been a very minor factor behind the increase in coarse grain use. The annual growth rate for 1950-65 was only .5 percent, very much below the rate for the world (2.0 percent), and even much below that for highly developed nations (1.2 percent). However, in the latter part of the period (1960-65), the rate increased to .8 percent.

Income in the United Kingdom did not increase much relative to that for most other developed nations. On a per capita basis, the gross national product grew 2.5 percent annually and consumer expenditures, 2.1 percent, during the period 1950-65. These figures are below the corresponding figures for all the other nations of the European Free Trade Association (EFTA) and the nations of the EEC. (The figures are comparable, however, with those for the United States).

Since population and income grew slowly, total and per capita meat consumption grew less than rapidly. This slow growth did not mean, however, that

Table 15.--Coarse grain utilization in the United Kingdom, 1956-67

Year ending June 30	Available supply	Human food consumption	Animal feed consumption	Other uses
	----- 1,000 m.t. -----			
1956	8,541	165	6,671	1,705
1957	8,763	162	6,822	1,779
1958	9,232	168	7,163	1,901
1959	10,447	173	8,273	2,001
1960	10,709	143	8,421	2,145
1961	11,015	139	8,558	2,318
1962	11,849	138	9,343	2,368
1963	12,327	143	9,745	2,439
1964	12,504	128	9,724	2,652
1965	12,837	125	9,905	2,807
1966	13,100	131	10,020	2,949
1967 <u>1/</u>	12,905	130	9,875	2,900

1/ Estimated.

Source: Commonwealth Secretariat. Grain Crops, various issues.

domestic meat production or coarse grain demand grew slowly. Generally, domestically produced meat is taking the place of imported meat. This replacement permits rapid growth in production and slow growth in consumption. This situation was particularly true for beef and veal. Beef production fluctuated considerably; nevertheless, the trend was strongly upward. Consumption increased slowly and, on a per capita basis, even declined a little. Beef and veal imports declined from a high of 439,000 metric tons in 1956/57, to a low 203,000 metric tons in 1965/66. In 1966/67, imports increased to 233,000 metric tons; nevertheless, the trend for imports was strongly downward in these years.

Even though there was a fairly high growth rate for meat production, the rate for coarse grain use was even higher. Essentially, there are two reasons. First, coarse grain use other than for food or feed grew fairly rapidly, as stated above. Second, the increase in meat production in the United Kingdom was primarily an increase in pork and poultry production. Coarse grains are a larger proportion of the diets of these animals than for those of cattle and sheep. Thus, the need for coarse grains grew largely because domestically produced pig and poultry meat was substituted for beef and veal imports. Coarse grain demand would not have grown quite so rapidly if the substitute for imported beef and veal had been domestically produced beef and veal.

Also, it is of interest that the United Kingdom's self-sufficiency efforts required that coarse grain production keep pace with the increase in domestic meat production.

United States

Trade patterns. -- Nearly 47 percent of the coarse grains entering world trade in 1963-65 originated in the United States. Exports from this country increased over a million metric tons a year on a trend basis in 1951-65, nearly an 11-percent annual increase. Almost all of the increase was in exports to other highly developed nations, mostly in the EEC. In 1963-65, one out of every 5 tons of coarse grains that entered world trade was a U.S. export to the Common Market. There were significant increases to EFTA in the 1960's and to Japan and Other Western Europe, primarily Spain. The proportion of U.S. exports shipped to the developing nations declined slightly over the long run and fluctuated considerably, between 6 and 22 percent (tables 16 and 17).

Historically, however, the United States must be considered an importer, as well as an exporter. Between 1951 and 1954, imports as a percentage of exports were:

	<u>Percent</u>
1951.....	20
1952.....	32
1953.....	56
1954.....	49

After 1954, imports were less than 15 percent of exports and by 1963-65, they had declined to a level of only 2 to 4 percent. As can be seen in table 18, practically all imports came from Canada, and most of the imports were barley and oats.

Table 17.--Percentage of feed grain exports by the United States, by destination of exports, 1951-65

Year	Developed nations										Less developed nations					
	Total 1/	EEC	EFTA	Japan	Western Europe:	Other Western:	Canada:	Eastern Europe:	Total 1/	Latin America:	South Asia:	Other East:	West Asia:	North Africa:		
															Percent 2/	
1951	100.0	79.2	34.8	21.2	12.8	7.0	3.4	3.3	17.6	3.0	11.0	2.0	.9	.1		
1952	100.0	76.7	28.9	29.2	7.8	5.0	3.6	.9	22.4	1.0	12.3	8.4	.6	--		
1953	100.0	75.6	30.0	26.7	8.6	4.6	2.5	3.9	20.6	9.5	3.2	6.1	.5	.2		
1954	100.0	90.1	29.6	40.9	11.6	2.7	5.4	1.0	8.3	4.8	0.0	2.6	.9	--		
1955	100.0	93.2	36.0	40.9	10.3	4.2	1.8	.5	6.3	1.5	--	.4	4.1	--		
1956	100.0	90.9	41.4	34.0	8.2	4.2	3.1	.9	8.2	2.7	--	4.1	1.5	--		
1957	100.0	77.4	29.8	33.2	7.1	3.3	4.1	0.0	22.5	14.2	--	4.7	3.6	--		
1958	100.0	66.7	30.6	31.1	8.6	3.2	3.2	3.9	19.4	10.8	1.6	3.8	3.1	--		
1959	100.0	89.7	38.1	40.8	4.5	3.5	2.8	3.0	7.3	1.5	1.2	.1	3.4	.7		
1960	100.0	86.4	39.2	38.2	2.3	2.9	3.8	2.6	11.0	2.7	2.2	.3	4.6	1.0		
1961	100.0	82.8	36.2	26.6	7.4	6.3	6.4	3.4	13.8	2.5	1.4	2.1	3.9	3.2		
1962	100.0	89.3	40.4	30.0	9.2	4.2	5.7	1.2	9.4	1.9	.6	.9	2.6	2.7		
1963	100.0	86.6	42.6	19.2	13.3	7.5	4.0	2.8	10.6	3.9	.5	1.4	2.9	1.3		
1964	100.0	87.3	40.1	18.8	17.0	7.9	3.4	3.1	9.6	1.9	.8	1.2	2.2	2.7		
1965	100.0	91.8	45.0	16.1	20.8	9.8	0.0	.2	8.0	1.7	1.2	.8	2.1	1.2		

1/ For many years, based upon data that included areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 18.--Feed grain imports by the United States, 1951-65

Year	Quantity			Market shares		
	Total	Canada	All Other	Total	Canada	All Other
	----- 1,000 m.t. -----			----- Pct. ^{1/} -----		
1951	1,142	1,124	18	100.0	98.4	1.6
1952	1,429	1,392	37	100.0	97.5	2.6
1953	2,464	2,420	47	100.0	98.2	1.9
1954	1,256	1,177	82	100.0	93.7	6.5
1955	681	651	31	100.0	95.5	4.5
1956	877	839	38	100.0	96.5	4.3
1957	969	942	28	100.0	97.2	2.8
1958	642	595	47	100.0	92.6	7.3
1959	438	410	28	100.0	93.6	6.4
1960	382	357	25	100.0	93.5	6.5
1961	548	519	29	100.0	94.7	5.3
1962	181	156	25	100.0	86.1	13.8
1963	135	135	0	100.0	100.0	0
1964	284	260	24	100.0	91.5	8.5
1965	149	126	23	100.0	84.5	15.4

^{1/} Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 19.--Acreage harvested for major feed grains, United States, 1954-67

Year	Total	Corn	Oats	Barley	Grain sorghums
	----- Million acres -----				
1954	134.3	68.7	40.6	13.4	11.7
1955	134.9	68.5	39.0	14.5	12.9
1956	120.3	64.9	33.3	12.9	9.2
1957	131.7	63.1	34.1	14.9	19.7
1958	126.1	63.5	31.2	14.8	16.5
1959	130.1	72.1	27.8	14.9	15.4
1960	127.5	71.4	26.6	13.9	15.6
1961	105.3	57.6	23.9	12.9	11.0
1962	101.9	55.7	22.3	12.2	11.6
1963	105.1	59.2	21.3	11.2	13.3
1964	97.1	55.4	19.8	10.3	11.7
1965	96.0	55.3	18.5	9.1	13.0
1966	97.8	56.9	17.9	10.2	12.8
1967	100.6	60.4	16.0	9.2	15.1

Source: U.S. Dept. of Agr. Agricultural Statistics 1968.

Production changes. -- The United States' most important feed grain is corn, followed by oats, grain sorghum, and barley, in that order. The United States produced an average of 152 million metric tons of these and other feed grains in cropyears 1966/67-1968/69 -- three times more than the USSR, the second largest producer. The trend on U.S. production was upward at a rate of 3.2 million metric tons per year between 1951 and 1969, a rate nearly six times larger than the size of the next highest trend (+552,000 metric tons for the USSR).

The very size of U.S. productive capacity, however, has been a problem. The United States has had a farm problem since the short but deep business depression of 1920-21. After this depression, prices of agricultural commodities did not recover as did prices in the nonagricultural section. By the 1930's, it was decided that price supports and production controls were both necessary to solve the farm problem. The first national legislation dealing with both aspects was passed in 1933. Since that time, it has been U.S. agricultural policy to assure adequate supplies, to stabilize markets and prices, and to equalize the farmers' bargaining position.

Certain basic approaches were used to achieve these goals. Price-support programs were instituted that used loans, purchase in lieu of loans, direct purchases, and payments. Tied to price-support programs were acreage allotments or marketing-quota programs or some combination of the two. In addition, land-retirement, adjustment, or diversion programs were used in conjunction with price-support programs, or as separate programs. Like acreage allotments and marketing quotas, these programs were instituted to bring production into reasonable balance with demand. Even with such programs, the United States often had surpluses. It therefore was necessary to institute commodity-storage, handling, disposal, and surplus-removal programs.

From the very beginning, corn was one of the commodities under price-support programs. Between 1954 and 1967, feed grain acreage harvested was reduced from approximately 134 million acres to about 100 million (table 19). Nonetheless, production has increased because of greatly higher yields.

During the Korean conflict, price supports were little used, although they were kept at high levels to insure adequate supplies if the conflict spread. Farm prices were strengthened, and most of the stocks acquired by the Commodity Credit Corporation (CCC) from the 1948 and 1949 crops were sold. However, for the next decade, supplies always exceeded demand, and the accumulation of stocks was to become burdensome.

Commodity inventories held by CCC at the end of fiscal year 1952 amounted to an investment of \$956.5 million; in fiscal year 1955, the total was \$4.6 billion, and in fiscal year 1960, the total amounted to \$6.02 billion.

To use agricultural abundance as a form of foreign aid and to further defense policies, the Agricultural Trade Development and Assistance Act of 1954 (Public Law 480) was passed. It combined or extended various programs already in existence. From its inception, and as amended by the Food for Peace Act of 1966, this law has been used as an instrument of U.S. foreign policy.

The Agricultural Act of 1956 provided for a two-phase soil-bank program to help farmers divert a part of their cropland from the production of excessive supplies. The acreage-reserve aspect of the soil bank authorized payment by the CCC to producers for retiring allotment acreage from production of basic crops on an annual basis. The conservation-reserve aspect authorized the CCC to make payments for shifting of cropland into grass that would not be harvested or for other conservation used over longer periods. The acreage-reserve program terminated in 1958, but land could be put under 10-year conservation-reserve contracts through 1960.

Low farm income, excessive production, and excessive Government stocks continued to be problems that closed out the 1950's. In 1961, emergency feed grain legislation was passed by the Congress. This legislation provided higher support levels for farmers who voluntarily reduced acreage of corn and grain sorghums by 20 percent or more. The Agricultural Act of 1961 established specific programs for the 1962 crops of wheat and feed grains, programs aimed at diverting acreage from these crops.

The Food and Agriculture Act of 1962 continued the feed grain program for 1963 and added barley to the program. Under this law, beginning in 1964, the national wheat acreage allotment of a minimum 55 million acres was permanently abolished. Subsequently, the Secretary of Agriculture could set allotments as low as necessary to limit production to the amount needed.

The Feed Grain Act of 1963 provided for an acreage-diversion program for the 1964 and 1965 crops of feed grains that was similar to the 1963 program. Supports were provided for corn at 65 to 90 percent of parity, with part of the support price as a direct payment (27) .

Changes in consumption. -- Increases in coarse grain use in the United States were far larger than increases in any other region. On a trend basis, the annual increase was 1.7 million metric tons; thus, in terms of quantity, the United States was its own fastest growing market. Use was already so high, however, that the annual rate of increase was only 1.4 percent, approximately.

On a per capita basis, consumption in the late 1960's was around 650 kilograms a year, a level exceeded only in Canada among the regions in this report. Less than 10 kilograms per capita were consumed directly as food -- the remainder was consumed either in the form of meat or industrial products.

Since the per capita consumption was very high, any increase in population was an important variable in the expansion of total use. Population increased at a rate of 1.6 percent per annum, somewhat higher than the 1.2 percent for highly developed nations as a whole, but less than the world average of 2.0 percent.

As is well known, per capita income in the United States was the highest in the world, and this permitted a high meat consumption. The growth rate for income was 2.3 percent. The medium income of families was \$7,436 in 1966, and nearly 30 percent of the families earned \$10,000 or more. Even with a high level of and a substantial growth in income, there were nevertheless many people consuming less meat than they desired. In 1966, a little over 15 percent of

the people in the United States were poor, by U.S. Government definition. The number of people defined as poor declined 30 percent between 1959 and 1966. Clearly any reduction in poverty increased the demand for meat, and thus, coarse grain use. In addition, the demand for meat grew as incomes increased for those with incomes above the poverty level, but below the level where the income elasticity for meat is zero.

Public Law 480. -- The direction and size of U.S. feed grain exports are determined to a significant degree by shipments under Public Law 480, the law establishing the Food for Freedom program. In 1957, approximately 31 percent of feed grain exports were under Public Law 480. The proportion declined to 12 percent in 1965 while the quantity exported commercially increased significantly in 1962 and remained at a very high level through 1965.

Shipments under Public Law 480 are based upon need without the availability of foreign exchange to purchase in the international market. Thus, it is humanitarian goals that to some extent determine the size and direction of U.S. feed grain exports. Under this criterion, a high proportion of Public Law 480 feed grains went to India.

Australia, New Zealand, and South Africa

Trade patterns. -- These three countries as a group are the world's third largest feed grain exporter. They import practically nothing. Their exports have grown but not at a particularly rapid rate. In 1962, an apex was reached, and exports dropped in each of the subsequent years through 1965 (tables 20 and 21). Of the exports shown in table 20, South Africa exported 56 percent and Australia, practically all of the rest. Very little is exported to the developing nations. The major destinations of these exports are the Common Market (especially Italy and Germany), the United Kingdom, and Japan.

South Africa's major coarse grain export is corn, but grain sorghum is growing in importance. Australia's major export is barley, followed by oats.

Production changes. -- The increase in production in South Africa was upward at 230,000 metric tons a year, roughly 4.7 percent. In Australia and New Zealand (primarily Australia) the trend was only 48,000 metric tons per year. The production in these two countries is only two-thirds of that in South Africa.

Corn accounts for over 90 percent of South Africa's coarse grain output. Corn production varies significantly from year to year, because of extreme weather variability, but there is a substantial upward trend in both area and yield. The extremely large crop in 1966/67 was due to very favorable weather. Sorghum production had increased to over 800,000 tons in 1966/67, but dropped abruptly in 1967/68 to only one-fourth this amount. As with corn, however, there is an uptrend in the area and yield of sorghum.

The Government of South Africa is extensively involved in the marketing and distribution of agricultural products. The substantial increase in agricultural output achieved during the postwar period can be attributed, at least

Table 20.---Feed grain exports by Australia, New Zealand, and South Africa, by destination of exports, 1951-65

Year	Total 1/	Developed nations				Total less developed nations
		Total 1/	Japan	EEC	EFTA	
----- 1,000 m.t. -----						
1951	684	564	111	178	257	120
1952	669	611	74	243	274	58
1953	835	759	222	188	323	76
1954	1,270	1,123	219	501	335	137
1955	1,072	1,057	215	573	251	15
1956	1,813	1,652	358	867	404	161
1957	1,690	1,523	525	721	277	167
1958	1,628	1,492	152	775	519	105
1959	1,790	1,768	333	849	580	22
1960	1,327	1,306	257	603	441	21
1961	2,374	1,858	450	690	665	93
1962	3,240	2,788	893	1,163	476	139
1963	2,920	2,727	786	1,101	825	173
1964	2,258	2,125	752	476	866	133
1965	1,128	989	207	359	411	97

1/ For many years includes areas not shown separately.

Source: U.S. Dept. of Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 21.--Percentage of export market shares for feed grain exports by
Australia, New Zealand, and South Africa, 1951-65

Year	Total 1/	Developed nations				Total less developed nations
		Total 1/	Japan	EEC	EFTA	
		Percent 2/				
1951	100.0	82.5	16.2	26.0	37.6	17.5
1952	100.0	91.3	11.1	36.3	41.0	8.7
1953	100.0	90.9	26.6	22.5	38.7	9.1
1954	100.0	88.4	17.2	39.4	26.4	10.8
1955	100.0	98.6	20.1	53.4	23.4	1.4
1956	100.0	91.1	19.7	47.8	22.3	8.9
1957	100.0	90.1	31.1	42.7	16.4	9.9
1958	100.0	91.7	9.3	47.6	13.5	6.5
1959	100.0	98.8	18.6	47.4	32.4	1.2
1960	100.0	98.4	19.4	45.4	33.2	1.6
1961	100.0	78.3	19.0	29.1	28.0	3.9
1962	100.0	86.0	27.6	35.9	21.6	4.3
1963	100.0	93.4	26.9	37.7	28.3	5.9
1964	100.0	94.1	33.3	21.1	38.4	5.9
1965	100.0	87.7	18.4	31.8	36.4	8.6

1/ For many years, based upon data that included areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

in part, to the degree of price stability inaugurated by the marketing boards. Exported corn is sometimes sold at a loss by the Government. Such sale is motivated by (1) a desire to maintain a relatively high level of corn production to assure self-sufficiency, (2) the political influence of corn producers, and (3) a desire to use corn sales as a source of foreign exchange earnings.

Coarse grain production in Australia increased over 40 percent from 1.9 million tons in 1955-57 to 2.7 million tons in 1965-67. The comparable increase for wheat was 135 percent. As a consequence, the proportion of coarse grains to total grains dropped from one-third in 1955-57 to one-fourth in 1965-67. The area in coarse grains increased by one-fourth between 1955-57 and 1965-67. Of particular interest in Australia is the development with foreign capital of new land areas. Production of sorghum for shipment to Japan is a major objective in this venture. Some newly developed areas in Australia are already being planted to sorghums, and small shipments have been made to Japan. The potential area for development of sorghum in the southern part of western Australia alone has been estimated at 810,000 hectares. Furthermore, yields of most grains increased substantially during the period under study because of increased use of fertilizer and improved grain varieties.

Australia currently depends on agricultural exports for about 70 percent of its foreign exchange earnings. In this respect, it is similar to the developing nations. The Government has emphasized the expansion of agriculture to assure food and raw materials for export markets, as well as for domestic needs. No production controls currently are placed on wheat and coarse grains; thus, growers have a free choice in deciding which grains to produce.

Most of the barley produced in Australia is sold through three grower-controlled marketing organizations. The barley is sold in the domestic and export markets at the best price, and total net proceeds are distributed to farmers in proportion to the quantities and in accordance with the varieties and grades of barley they delivered.

Australia has a technically dynamic agriculture. Capital inputs are steadily applied, especially in the form of machinery and equipment. Also there have been substantial increases in the application of fertilizer and other agricultural chemicals.

Consumption changes. -- Total use of feed grain in Australia and New Zealand increased on a trend basis over 100,000 metric tons a year, more than 6.5 percent annually. In South Africa, consumption grew more slowly -- 67,000 metric tons, or less than 2 percent a year. On a per capita basis, the increase in Australia and New Zealand together was nearly 6 kilograms a year, the highest among the regions in this report. The rate of increase in South Africa is low because the level of direct consumption was already high, one of the highest in the world.

Increases in population were greater in these three countries than in developed countries as a whole. The increases were in 1950-65:

	<u>Percent</u>
Australia.....	2.3
New Zealand.....	2.2
South Africa.....	2.4
Developed nations.....	2.0

Each country has, however, a population that must be classified as outside the developed society or market economy. This is particularly true in South Africa. Consumer expenditures on a per capita and constant dollar basis grew by the following rates in 1950-65:

Australia.....	1.4
New Zealand.....	1.2
South Africa.....	5.3

The rate for South Africa is one of the highest in the world. Since direct consumption of coarse grain -- especially corn -- is already very high, additions to income are not likely to increase this type of consumption. Meat consumption may increase, but this will require an accelerated quantity of grains and thereby cut into the quantity available for exporting.

The price and status of gold. -- South Africa produces about 70 percent of the world's gold, and this metal is the country's primary export. Since the spring of 1968, the leading financial countries of the world have refused to buy gold at any price. There has been a free market for gold in which the price has fluctuated between \$37 and \$45 an ounce. No official figures are available on the quantity of gold sold in London, Zurich, and other gold markets, but the increases in South Africa's official holdings of gold indicate that not much has been sold. This has put pressure on South Africa to earn foreign exchange from other exports. One of its best opportunities is the exportation of corn and grain sorghum.

Canada

Trade patterns. -- Canadian exports declined 56 percent between 1951-53 and 1963-65. In 1951-53, Canada was second only to the United States as an exporter but in 1963-65, it was seventh among the regions in this report. Nearly all of the decrease resulted from lower exports to the United States. About 50 percent of the Canadian exports in 1951-53 went to the United States but by 1963-65, the U.S. share was only 10 percent or so. Exports to Japan dropped, but Japan's share of Canada's exports remained about the same. The Common Market and EFTA took 37 percent of Canada's exports in 1951-53, but in 1963-65, they were taking 63 percent. Very little was exported to less developed nations (tables 22 and 23).

Table 22.--Feed grain exports by Canada, by destination of exports, 1951-65

Year	Total 1/	Developed countries					Eastern Europe	Less developed countries	
		Total 1/	United States	Japan	EEC	EFTA		Total 1/	Latin America
----- 1,000 m.t. -----									
1951	2,069	2,069	1,124	124	482	317	---	---	---
1952	3,214	3,196	1,392	473	983	345	---	18	16
1953	4,312	4,176	2,417	279	634	829	---	136	14
1954	2,341	2,319	1,174	333	107	695	---	22	22
1955	1,950	1,935	650	104	191	988	---	15	15
1956	2,002	1,957	839	221	103	794	27	18	18
1957	1,934	1,910	941	273	161	535	3	21	21
1958	2,059	1,951	592	147	60	1,114	2	---	---
1959	1,724	1,612	408	115	116	973	95	17	3
1960	1,385	1,256	350	2	160	738	116	13	2
1961	1,446	781	454	18	60	209	---	4	4
1962	976	763	129	5	143	469	---	10	10
1963	1,168	1,100	134	40	353	567	1	43	22
1964	1,639	1,160	196	85	260	610	82	35	17
1965	1,363	1,211	123	249	281	540	---	25	21

1/ For some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Production changes. -- There was practically no change on a trend basis in Canadian coarse grain production from 1951 to 1968. Planted coarse grain area dropped from 9.1 million hectares per year in 1955-57 to 7.5 million in 1965-67, an 18-percent decrease. Despite lower area, Canadian coarse grain production remained constant except for year-to-year fluctuation. This situation is due to the general rise in yields caused by increased levels of inputs and improved grain varieties. Barley and corn yields were up more than 40 percent, oat yields, 16 percent, and rye yields, about 27 percent.

Improved agricultural practices, new grain varieties, and increased use of fertilizer and machinery have contributed to the higher production in recent years. Total fertilizer sales for consumption rose by nearly 80 percent in Canada between 1961/62 and 1965/66. Development and use of short-season corn varieties and expanding area, largely in Ontario Province, have resulted in rapid increases in corn production. This expansion in corn production is expected to continue for the near future.

The Canadian Wheat Board, assisted by the Board of Grain Commissioners and by the private grain trade, operates a monopoly for commercial marketing, including exports on behalf of grain producers (wheat, barley, and oats) in the Prairie provinces. In addition to pricing activities, the Board buys, stores, and sells or otherwise disposes of grains under pooling arrangements for various grades of each crop. It has the power to establish delivery quotas based upon permit books issued to each producer or producer group, to promote orderly production and marketing.

Consumption changes. -- On a per capita basis, Canada is one of the world's largest users of coarse grains, even though the trend has been downward at over 4 kilograms a year. Coarse grain consumption declined on a per capita basis in the late 1950's but in the mid-1960's, the decline was halted, and consumption even increased some. Slightly increased production of livestock and poultry accounted for the larger consumption.

Even with a declining use on a per capita basis, use increased in the aggregate -- due obviously to a rapid rate of growth in population. Between 1950 and 1965, the rate of increase was 2.4 percent, a rate exceeded or matched by very few highly developed countries. The rate of growth appears to be slowing, however. In 1960-65, the rate was only 1.8 percent.

There was little or no growth in per capita consumer expenditures for all commodities from 1950 to 1955, but a rapid growth from then until 1965. For the entire period, the rate was 2.1 percent.

Overall change. -- In Canada, there was (1) practically no change in production over the long run, (2) an increase in aggregate consumption due largely to an increase in population, and (3) a decline in exports. Part of the decline in exports was due to an increase in production in the United States. In addition, Canada's exports decreased because its primary feed grains are barley and oats, and these have been at a competitive disadvantage with corn in the world market. The growing season for many varieties of corn is too long for much to be grown in Canada.

USSR

Trade patterns. -- The USSR is basically an exporter, but in some years it imports small quantities. In 3 of the 5 years, 1960-65, coarse grain exports were over 2 million metric tons, which is, on the average, higher than in the 1950's. However, exports from the USSR fluctuated considerably, and no strong trend over the entire period is apparent. Practically all exports went to European nations. Between 1951 and 1957, the quantity exported to Eastern Europe increased rapidly but since then, exports to this region fluctuated and showed no strong trend (tables 24 and 25).

Production changes. -- The Soviet Union is second only to the United States in the level of, and absolute increase in, production of coarse grain. However, it is a distant second, and the percent increase is less than half that for the United States. Furthermore, precision is impaired in the analysis of past trends in yields and production of coarse grains in the USSR because of its practice of reporting such data as "bunker weight." To approximate "barn yields" and usable production, it is necessary to eliminate from the reported data excess moisture and foreign matter. Such adjustments affect both the level of production and the rate of change over time.

Two factors were critical in determining the direction and level of coarse grain production in the USSR: (1) Major changes in some areas have altered greatly the composition of coarse grain production; and (2) agricultural policy -- including changes in prices, farm incentives, capital investment, and the availability of machinery and fertilizer -- has developed in a discontinuous pattern. There are, therefore, distinct periods in which agricultural policy had a positive or negative impact upon the output of all crops and livestock products.

The area planted in rye decreased steadily from 23.7 million to 16 million hectares between 1950 and 1965. The relative position of area in barley and oats was reversed in about 1960. Until then, barley had fluctuated between 8 million and 12 million hectares, but in 1960 shot up to about 20 million hectares. Area in oats ranged between 13 million and 16 million hectares until 1960, and then dropped to less than the barley average. The area in corn was 4.8 million hectares in 1950, reached 6.6 million in 1956, fell to 3.3 million in 1957, and then rose again to 7 million hectares in 1961. Corn area has fallen again to its present level of about 3.2 million hectares.

Agricultural policies during 1953-57 greatly improved the level of farm prices and incentives, the availability of machinery and fertilizer, and the level of agricultural investment. During the period, yields of all coarse grains increased, with those of barley and corn exceeding those of rye and oats. Between 1958 and 1963, a change in agricultural policy produced little improvement in yields. Another change in agricultural policy in late 1964 stimulated an increase in yields.

Table 24.--Feed grain exports by the USSR, by destination of exports, 1951-65

Year	Total 1/	Developed nations					Other	Eastern Europe
		Total 1/	EEC	EFTA	Western Europe			
----- 1,000 m.t. -----								
1951	1,181	1,150	176	909	65	31		
1952	1,487	1,040	120	804	116	447		
1953	867	445	108	209	128	422		
1954	1,058	273	126	100	47	785		
1955	1,127	221	23	89	109	906		
1956	1,772	549	222	191	136	1,223		
1957	2,306	692	345	227	120	1,614		
1958	1,032	284	105	114	65	748		
1959	1,335	455	136	167	142	880		
1960	1,538	431	174	174	83	1,107		
1961	1,656	1,094	279	740	68	462		
1962	2,692	639	287	261	91	1,916		
1963	2,243	521	173	134	89	1,537		
1964	1,307	58	34	2	22	1,043		
1965	2,582	417	244	96	77	1,985		

l/ In some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 25.--Percentage of feed grain exports by the USSR, by destination of exports, 1951-65

[illegible]

1/ In some years, based upon data that included areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Consumption changes. -- Coarse grain use increased only 262,000 metric tons a year on a trend basis. This represents only a .6-percent increase, and on a per capita basis, a decline of .5 kilograms a year.

Between 1950 and 1965, cattle numbers in the USSR increased 50 percent, and cow numbers increased 58 percent. Hog numbers grew from 22.4 million to 70 million between 1950 and 1963, but dropped sharply to 41 million during 1963. They recovered to almost 60 million by 1966. Sheep numbers grew from 78 million to 138 million between 1950 and 1965, while goat and horse numbers declined. Both milk and meat production doubled between 1950 and 1965, egg output tripled, and wool production increased 123 percent. Between 1965 and 1968, output of each of these four commodities increased another 15 percent.

These increases in numbers and output took place despite the relatively slow growth in feed grain production from 1950 to 1968. The only major nongrain feed source to increase significantly during the period was silage and other succulent feeds. Roughage and potatoes remained about the same, and major improvements in pastures do not appear to have taken place. There is evidence that wheat and rye became increasingly more important as livestock feeds after 1958, and that feeding of wheat increased further after the exceptionally large crop of 1966.

Eastern Europe

Trade patterns. -- This area as a whole is a net importer. From 1954 through 1961, imports by Eastern Europe fluctuated around the 1.7 million-metric-ton-mark. For the next 4 years, imports moved to a plateau near the 3.0 million-metric-ton-level. The USSR was the major supplier, fulfilling between one-third and two-thirds of Eastern Europe's feed grain deficit, except in 1951. The Latin American nations have occasionally supplied as much as one-fourth of the imports but, typically, none of the less developed nations were major suppliers. Imports from the highly developed nations have fluctuated widely but the United States was usually the primary source among these nations. A fair proportion of trade occurs among the nations of Eastern Europe (tables 26 and 27).

Production changes. -- The feed grain production trend in Eastern Europe is upward (table 28). ^{5/} About 27 percent of the production comes from Poland, and its major crop is rye (table 29). However, corn is the major feed grain in Eastern Europe -- nearly 47 percent of the total -- and it is grown mostly in Romania and Yugoslavia.

Changes in the area and structure of feed grain production in Eastern Europe were brought about largely under agricultural policies and programs that were guided by the politicoeconomic dictum that maximum output and efficiency

^{5/} Data published by Communist countries are not always comparable with agricultural statistics published by non-Communist countries. For a more complete discussion on Communist agricultural data see (10, pp. 1-91).

Table 26.--Feed grain imports by Eastern Europe, by source of imports, 1951-65

Year	Developed nations		Central plan nations		Less developed nations		
	Total 1/		EEC : EFTA		USSR : Eastern Europe : Total 1/		
	United States :	EEC :	EEC :	EFTA :	USSR :	Eastern Europe :	Latin America : Western Asia
	184	184	---	---	---	---	---
1951	299	184	---	---	31	21	19
1952	833	47	6	---	447	7	7
1953	1,087	193	16	9	422	45	9
1954	2,000	101	25	48	785	466	447
1955	1,458	159	32	24	906	224	163
							24
1956	2,278	405	59	48	1,223	138	50
1957	2,479	223	3	30	1,614	102	16
1958	1,503	391	352	37	748	170	62
1959	1,778	469	326	8	880	42	2
1960	1,944	481	265	100	1,107	8	---
							8
1961	1,360	583	353	115	462	21	11
1962	2,882	650	192	329	1,916	58	---
1963	2,980	935	405	167	1,537	125	9
1964	2,930	1,166	477	144	1,043	423	210
1965	3,429	92	28	13	1,985	946	809

1/ For some years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 27.--Percentage of feed grain imports by Eastern Europe, by source of imports, 1951-65

Year	Developed nations				Central plan nations		Less developed nations				
	Total 1/	United States		EEC	EFTA	Eastern Europe		USSR	Total 1/	Latin America	Western Asia
		Total 1/	States								
----- Percent 2/ -----											
1951	100.0	61.7	61.7	---	---	---	10.4	7.0	6.4	---	---
1952	100.0	5.6	4.9	.7	---	39.8	53.6	.8	.8	---	---
1953	100.0	17.8	15.5	1.5	.8	35.6	38.8	4.1	.8	3.1	
1954	100.0	5.1	1.3	.9	2.4	32.4	39.3	23.3	22.4	.1	
1955	100.0	10.9	2.2	7.1	1.6	11.6	62.1	15.4	11.2	1.6	
1956	100.0	17.8	2.6	11.9	2.1	21.6	53.7	6.1	2.2	3.6	
1957	100.0	9.0	.1	7.5	1.2	20.9	65.1	4.1	.6	3.0	
1958	100.0	26.0	23.4	---	2.5	11.3	49.8	11.3	4.1	4.5	
1959	100.0	26.4	18.3	2.2	.4	16.3	49.5	2.4	.1	2.1	
1960	100.0	24.7	13.6	---	5.1	17.0	56.9	.4	---	.4	
1961	100.0	42.9	26.0	8.5	8.5	21.5	34.0	1.5	.8	.7	
1962	100.0	23.0	6.7	4.5	11.4	9.0	66.5	2.0	---	1.3	
1963	100.0	31.4	13.6	11.5	5.6	12.9	51.6	4.2	.3	2.2	
1964	100.0	39.8	16.3	15.8	4.9	10.2	35.6	14.4	7.2	2.9	
1965	100.0	2.7	.8	1.5	.4	11.8	57.9	27.6	23.6	.7	

1/ For some years, based upon data that included areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 28.--Coarse grains supply and distribution, Eastern Europe, 1951-68

Year 1/ ending June 30	Production	Imports 2/ 1,000 m.t.	Total supply	Imports	Disappearance	
					Domestic	Per capita
						kg.
1951	28,402	167	28,569	135	28,434	268
1952	34,888	164	35,052	756	34,296	320
1953	28,477	194	28,671	260	28,411	262
1954	32,848	313	33,161	307	32,854	300
1955	32,358	435	32,793	396	32,397	293
1956	38,488	518	39,006	528	38,478	344
1957	33,216	324	33,540	238	33,302	295
1958	41,885	357	42,242	826	41,416	363
1959	35,390	466	35,856	617	35,239	307
1960	43,075	619	43,694	896	42,798	369
1961	42,992	491	43,483	1,073	42,410	363
1962	40,020	249	40,269	1,111	39,158	333
1963	38,951	665	39,616	978	38,638	326
1964	40,641	1,414	42,055	1,135	40,920	342
1965	42,304	1,185	43,489	802	42,687	354
1966	42,238	1,782	44,020	668	43,352	357
1967	47,375	1,195	48,570	1,546	47,024	384
1968	46,089	n.a.	n.a.	n.a.	n.a.	n.a.

1/ July-October harvest.

2/ FAO World Grain Trade Statistics.

Table 29.--Feed grain production in Eastern Europe,
by type of grain and country, average 1964-66

Country	Rye	Barley	Oats	Corn	Total
			1,000 m.t.		
Albania ^{1/}	6	3	15	169	193
Bulgaria	57	901	145	1,834	2,937
Czechoslovakia	827	1,479	682	445	3,433
East Germany	1,814	1,557	745	1	4,117
Hungary	265	915	63	3,660	4,903
Poland	7,677	1,382	2,475	15	11,549
Romania	106	439	124	6,864	7,533
Yugoslavia	169	643	339	6,953	8,104
Total	10,921	7,319	4,588	19,941	42,769

1/ 1964 only.

Source: (10).

could be achieved simultaneously with the collectivization of resources. As a consequence, collectivization is now firmly rooted in all countries of Eastern Europe except Yugoslavia and Poland. The process of collectivization occurred not all at once but over a period of years. In 1950, Bulgaria, Czechoslovakia, East Germany, Hungary, and Romania had only relatively small proportions of their arable land in State or collective farms -- anywhere from 6 to 27 percent (table 30). By 1966, the proportions increased to 90 percent or more. Data for Albania are not available.

Under collectivization, farms were consolidated, marginal farmland was abandoned, inputs were applied on a mass basis, and modern farm technology was adopted. Within the collectivization process, the primary forces causing change were: (1) the movement of people from confiscated and marginal farmland in some countries and (2) the conversion of large estates to pastureland in other countries. Furthermore, the increased use of land for industrialization and urbanization reduced the amount of arable land in all countries. As a result, total arable land between 1950 and 1965 decreased in Czechoslovakia, East Germany, Hungary, and Poland, while, at the same time, there was a small increase in Bulgaria, a modest increase in Yugoslavia, and a relatively large increase in Romania. Overall, arable land in Eastern Europe declined.

Despite expectations, economic goals were not achieved under collectivization. In recognition of this failure, increased agricultural growth became more important than further collectivization in the last half of the 1960's. Priority, for example, is now given to the increased use of fertilizer, machinery, and other inputs. A second level of priority is given to reforms in pricing policies, followed by priorities given to reforms in management and organizational programs that leave more of the day-to-day decision making to farm managers. Before the introduction of major economic reform (which began as early as 1953 in Yugoslavia), the capital needed for agricultural development was supplied principally from the State budget of each country. Allocation of funds was thus a function of State planning and was under rigid central control. Under the more recent economic reform programs, governments began reducing the direct State contribution of capital to agriculture and have shifted this obligation to the farm enterprises -- a move toward decentralization.

To enable collective farms to accumulate capital for the purchase of old and new equipment, the procurement prices of agricultural products have been constantly reviewed and adjusted upwardly. Governments have also cancelled past debts of some farms entirely or have extended long-term credits at low-interest rates to others. These changes in attitude reflect initial attempts to increase the total amount of fixed capital investment on farms through application of capitalistic techniques.

Under Communism, self-sufficiency was another broad agricultural policy, at least through 1955. Subsequently, the policy was to diversify the agricultural sector by reallocating resources from grain production to production of strategically important crops and livestock products. The net result was to reduce coarse grain acreage from nearly 23 million hectares in the early 1950's to roughly 20.5 million hectares in the late 1960's. The area used for barley and corn changed very little, while that for rye and oats declined. The drop in rye production resulted from a desire to shift acreage from rye to wheat

Table 30.--Percentage of agricultural area held by State and collective farms, Eastern Europe, 1950-66 1/

[illegible]

1/ Includes private plots.
2/ Data for Albania not available.

Source: (10).

varieties that give higher yields. The decline in the area sown to oats is partially attributed to the sharp decrease in horses in many countries.

Yields have increased more than enough to offset declines in overall acreage. As stated above, under collectivization, farms were consolidated, marginal land abandoned, and modern farm technology applied. However, these changes have created some problems. Accompanying these changes was a shift in the population from farm to nonfarm areas. Within this shift, there was a rapid outflow of young people from the farms, and this created a labor shortage in the agricultural sector. This shortage, in turn, accelerated the need for equipment. The increase in tractors and other machinery in Eastern Europe in agriculture has been relatively rapid since 1950.

Not all increases in production, of course, should be attributed to additions to fixed capital. Changes in use of hybrid seeds, animal vaccines, herbicides, and insecticides have been important also. However, sufficient data are not available for analysis.

On the average, fertilizer availability in Eastern Europe increased over 9 percent annually (table 31). The 1964-66 average application rate to all arable land in East Germany and Czechoslovakia was quite high -- 260 and 148 kilograms per hectare, respectively. The corresponding figure for the other countries ranges between 25 kilograms per hectare for Romania and 82 for Bulgaria. The wide dispersion among countries partly accounts for the significant difference in yields throughout Eastern Europe. Since fertilizer is already heavily applied in East Germany and Czechoslovakia, it is not very likely that additional applications will increase yields greatly. Clearly, the opportunity to increase yields in other countries is much greater.

Although the resources applied to food production increased, there have been problems in efficient use of these resources. These problems reflect the weaknesses of management in the collective system. To correct these weaknesses, incentives offered to management are increasing, and a continuation of the increase in resources will favorably influence the future role of agriculture in Eastern Europe.

Nevertheless, weather is still an important factor in Eastern Europe, despite all the efforts of mankind. When climatic factors are poor, there is a need to significantly increase feed grain imports to meet consumption requirements.

Changes in consumption. -- Total use of coarse grains increased considerably during 1950-68, but at a very irregular rate. For example, a peak was reached in 1960 that was followed by a 3-year decline, and then by a year-to-year increase for the next 5 years. For the entire period, the trend coefficient was nearly a million-metric-ton-increase per year, the highest for any area in this report except for the United States. This increase is only partially met by increased production. Per capita consumption has been increasing on a trend basis at approximately 5.4 kilograms a year. In 1966-68, per capita consumption was 365 kilograms a year, about halfway between consumption in South Asia and in North America.

Table 31.--Fertilizer availability (plant nutrients), Eastern Europe, 1950-66

[illegible]

Note: n.a. = Not available.

Source: (10).

Population growth accounts for very little of the increased consumption. Eastern Europe's growth rate of only 0.9 percent per annum for 1950-55, is the lowest of any area in the world for that period. Furthermore, this rate was only 0.8 percent in 1960-65. Primary causes for such a low growth rate were the absolute decline in the East German population and growth rates of less than 1.0 percent for Hungary, Bulgaria, and Czechoslovakia.

According to the most accurate and available data, incomes in Eastern Europe increased at a high rate -- roughly 8.0 percent per annum. Accompanying these increases were increases in consumption of meat and livestock products. The highest consumption of meat and meat products in 1966 was noted in Czechoslovakia and East Germany, where per capita consumption amounted to 62 and 55 kilograms, respectively. Hungary had the highest consumption of poultry, 12 kilograms, and Poland, the highest consumption of milk and milk products, 240 kilograms.

Matching these increases were declines in per capita consumption of cereals and potatoes. Nonetheless, consumption of these low-protein items is still high. In 1966, bread grain consumption (in terms of flour) was reported to be 212 kilograms per capita in Bulgaria. Corn consumption is still high in Romania and Yugoslavia, where consumption in 1966 was estimated at 54 and 28 kilograms per capita, respectively. Some corn is also consumed in Bulgaria, but in all countries, consumer preference has shifted to wheat and rye. Per capita potato consumption in Poland is over 200 kilograms per year, and in East Germany, roughly 150 kilograms.

Food, moreover, is still the most expensive item in the household budget. Current estimates indicate that approximately 45 percent of the disposable income of urban workers is spent on food, varying from 43 percent in Czechoslovakia to approximately 54 percent in Yugoslavia. This high proportion of family income spent on food, compared with Western Europe, results partially from lower costs of rents and services in Eastern Europe. It nevertheless indicates a need by consumers to restrict their purchases of meat and other high-cost items that represent indirectly a significant demand for feed grains.

Less Developed Countries

Latin America

Trade patterns. -- This region is both an importer and an exporter, but imports are only a small percentage of exports, and intraregional trade accounts for very little of Latin America's trade.

Exports by this area increased very significantly in 1950-65. The trend was upward at 250,000 metric tons, or roughly 8 percent per year. The largest outlet for these exports is the Common Market. In all but 1 year, more than one-half the exports were shipped there. As much as 81 percent were shipped in 1 year. The trend on this trade is upward at more than 200,000 metric tons a year. Furthermore, the proportion exported to the EEC increased through 1965. Since 1965, Common Market corn imports continued upward, but the proportion obtained from Argentina declined by 14 percent. The next largest market is

EFTA, but it is declining. Typically, only 2 or 3 percent of exports go to other less developed nations, mostly to other Latin American countries (tables 32 and 33).

During 1961-66, Argentina accounted for about three-fourths of the coarse grain exports from Latin America, although exports fluctuate considerably from year to year. About 70 percent of Argentina's coarse grain exports was corn and therefore, over one-half of Latin America's feed grain exports is Argentine corn. Mexican and Brazilian corn exports became very sizable in the early and mid-1960's. Altogether, corn exports in the 1960's accounted for three-fourths of total coarse grain exports from Latin America. Prior to 1965, Mexico was a net importer of corn.

Production changes. -- Although Argentina is the largest coarse grain exporter, Brazil is the largest producer, and Mexico produces almost as much as Argentina. Almost all of Brazil's production of coarse grains is corn and in 1965-67, she was the third largest producer in the world. Through 1964, however, only a very small percentage of production was exported. Yields increased only slightly, but acreage increased from about 5.9 million hectares in 1955-57 to 8.4 million in 1965-67.

In Brazil, corn plantings, the bulk of the coarse grain area, have increased rapidly in recent years. Because of ecological and disease problems with wheat, future expansion of grain production will be in rice, corn, and sorghum. Most of the Brazilian corn exported is the flint type, but the Government expects to improve its future export position by emphasizing output of soft hybrid varieties. During 1965-67, corn exports increased substantially and averaged almost 5 percent of production. In 1964, the Brazilian Government established a system of higher support prices to provide an incentive for producers to expand corn production.

In Mexico, production of coarse grains expanded rapidly in recent years -- from 4.8 million tons in 1955-57 to 9.6 million in 1965-67. Corn accounted for most of the increase. Corn is, by far, the leading grain in Mexico, but grain sorghum has become important since its introduction in the early 1950's. The area in corn increased one-third from 1955-57 to 1965-67, in contrast to decreases for both barley and oats. During the same period, average corn yields improved 37 percent, oats, 12 percent, and barley, 23 percent.

Mexican agricultural policies are directed toward increased self-sufficiency in the basic crops; these policies feature price and marketing assistance and stiff barriers against agricultural imports. Increased irrigation, associated with greater use of fertilizer and hybrid seed, brought about higher yields.

Argentina's coarse grain production increased nearly 60 percent between 1955-57 and 1965-67. Most of this was due to a relatively large expansion in corn and grain sorghum production. Coarse grain area increased 9 percent from 1955-57 to 1965-67. Corn and grain sorghum acreages expanded, with land being shifted from production of barley, oats, and rye. Argentine corn yields dropped sharply after World War II, but with the aid of hybrid seed, yields have increased over 37 percent between 1955-57 and 1965-67, which results in a

Table 32.--Feed grain exports by Latin America, by destination of exports, 1951-65

Year	Total 1/	Developed nations						Less developed nations				
		Total 1/	EEC	EFTA	Other	Japan	Eastern Europe	Total 1/	Latin America	West Asia		
----- 1,000 m.t. -----												
1951	1,036	980	670	234	53	5	19	37	37	---		
1952	1,410	1,372	818	451	32	35	7	31	31	---		
1953	1,811	1,673	757	867	5	---	9	129	95	---		
1954	4,517	4,006	2,646	1,038	160	83	447	64	52	10		
1955	1,807	1,584	1,121	341	88	4	163	60	60	---		
1956	2,097	2,003	1,573	335	26	31	50	44	44	---		
1957	2,185	2,136	1,774	261	60	14	16	33	33	---		
1958	3,136	2,995	2,106	720	9	136	62	79	75	---		
1959	3,113	2,989	2,044	644	3	270	2	122	104	3		
1960	4,477	4,373	3,181	706	20	441	---	94	90	1		
1961	2,685	2,586	1,828	441	2	286	11	88	87	---		
1962	4,081	3,661	2,901	669	13	53	---	112	112	---		
1963	3,556	3,384	2,845	369	49	121	9	150	110	25		
1964	4,872	4,247	3,398	424	151	250	210	383	362	10		
1965	5,872	4,918	3,801	474	218	402	809	145	95	14		

1/ For many years includes areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 33.--Percentage of feed grain exports by Latin America, by destination of exports, 1951-65

Year	Developed nations										Less developed nations			
	Total 1/	Total 1/	EEC	EFTA	Western Europe	Other	Japan	Eastern Europe	Total 1/	Latin America	West Asia			
1951	100.0	94.6	64.7	22.6	5.1	.5		1.8	3.6	3.6	---			
1952	100.0	97.4	58.1	32.0	2.3	2.5		.5	2.2	2.2	---			
1953	100.0	92.4	41.8	47.9	.3	---		.5	7.1	5.2	---			
1954	100.0	88.7	58.6	23.0	3.5	1.8		9.9	1.4	1.2	.2			
1955	100.0	87.7	62.0	18.9	4.9	.2		9.0	3.3	3.3	---			
1956	100.0	95.5	75.0	16.0	1.2	1.5		2.4	2.1	2.1	---			
1957	100.0	97.8	81.2	11.9	2.7	.6		.7	1.5	1.5	---			
1958	100.0	95.5	67.2	23.0	.3	4.3		2.0	2.5	2.4	---			
1959	100.0	96.0	65.7	20.7	.1	8.7		.1	3.9	3.3	.1			
1960	100.0	97.7	71.1	15.8	.4	9.9		---	2.1	2.0	---			
1961	100.0	96.3	68.1	16.4	.1	10.7		.4	3.3	3.2	---			
1962	100.0	89.7	71.1	16.4	.3	1.3		---	2.7	2.7	---			
1963	100.0	95.2	80.0	10.4	1.4	3.4		.3	4.2	3.1	.7			
1964	100.0	87.2	69.8	8.7	3.1	5.1		4.3	7.8	7.4	.2			
1965	100.0	83.8	64.7	8.1	3.7	6.8		13.8	2.5	1.6	.2			

1/ For many years based upon data that included areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

level exceeding that of the World War II years. Relatively high yields have made grain sorghums strongly competitive with other crops for land use. Government discouragement of inefficient sugarcane production may result in a portion of this land being shifted to grain production.

Corn yields in Argentina are uniformly low compared with those of competing countries; fertilizer application is not a regular practice because of easy early successes with fertile soil. Fertilizers can be used effectively on many soils, but research is needed to determine optimum levels.

Argentina has great unused capacity for increasing production of many agricultural products. The quantity of grain that can be absorbed in world trade thus will be a determining factor in how much Argentina produces in future years. Production increases for corn and grain sorghum should offset possible reductions in rye, barley, and oat production. For a large expansion in coarse grain production, Argentina would need new varieties, more mechanization, and wider use of fertilizer, as well as lower cost fertilizer.

Consumption changes. -- Use grew at 870,000 metric tons a year during 1950-65, roughly 3.8 percent a year -- a very large increase by any measure. Growth was particularly significant in Central America, approximately 4.6 percent per annum.

Population growth in Latin America during 1950-65 was the highest of any region in the world, 2.8 percent, well above the average for less developed nations, 2.4 percent, and for the world, 2.0 percent. Costa Rica had a growth rate of 3.8 percent, the highest of any other nation in the world.

Figures of sufficient quality that measure economic growth do not exist for several Latin American nations, and therefore, no overall rate can be computed. For some countries, the growth rate for the gross national product was quite high for 1950-65, even in constant dollars. The rate in several important countries was: Venezuela, 7.0 percent; Mexico, 6.0 percent; Brazil, 4.9 percent; and Peru, 5.6 percent. These rates are reduced considerably, however, when calculated on a per capita basis.

The quantity of coarse grains for direct human use varies considerably from country to country in Latin America. On a per capita basis, it is less than 5 kilograms a year in Argentina, Uruguay, Chile, and several smaller areas. This is based on 1960-62 data. It is nearly 125 kilograms in Guatemala, and just over 110 in El Salvador.

Meat consumption varies considerably too. In Haiti, it is only 9 kilograms a year but approximately 100 kilograms a year in Argentina and Uruguay.

Little information is available on grain use in Brazil. The rather rapid expansion in hog and broiler production has undoubtedly increased feed grain requirements, and total consumption of feed grains has increased. However, there is evidence of a negative income elasticity for direct consumption of corn, indicating a probable decline in consumption of corn for food. In Argentina, more grain was used in hog rations, and the poultry industry began to increase its activities. In Mexico, per capita consumption of corn will

probably decline, but there is expected to be an expansion in aggregate direct consumption for cereals and in their use for livestock feeding and industrial use.

South Asia

Trade patterns. -- This area is heavily dependent upon the United States for coarse grain imports, mostly under Food for Freedom programs (Public Law 480). In the early 1950's, some imports were obtained from Australia, New Zealand, and South Africa, but this region is no longer an important source (tables 34 and 35). Communist Asia was an important source, but after 1952, this area disappeared completely as a source.

Production and consumption. -- Coarse grain production has increased in South Asia. In the early 1950's, production averaged around 20 million metric tons; by cropyear 1968, it was over 30 million (table 36). Relative to the size and rate of population growth, however, the increase in production is not very outstanding. Production and population both grew at approximately 2.2 percent, compounded annually (table 37). Furthermore, the production of 30.5 million metric tons in 1968 was unusually high. During prior years of the decade, production fluctuated closely around 26 million metric tons. The sizeable increase in 1968 results partly from the adoption of hybrid corn seeds, greatly increased use of fertilizer, better use of irrigation facilities, and generally improved agricultural practices. As is very often the case in sudden production increases, favorable weather was also a factor.

India, in its fourth 5-year plan, which began in 1966, gave top priority to agriculture, population control, and supporting industries. Strenuous efforts were made, and are being made, to maximize agricultural production and thereby enlarge rural incomes. These efforts include the expansion of fertilizer production and the production of other agricultural inputs. In cropyears 1966 and 1967, the lack of rain at the proper time more than offset the Indian Government's efforts. However, in 1968, the rains came, and production records were set.

In the diets of the people of South Asia, rice and wheat rank higher than coarse grains. Meat consumption is nil. Per capita consumption of coarse grains will never reach high levels in any nation unless meat consumption becomes a significant proportion of the national diet. Per capita consumption in South Asia is roughly 45 kilograms per year, quite small relative to 214 kilograms for the Common Market and 626 for the United States. As is well known, incomes in South Asia are extremely low, which permits little consumption of meat. Moreover, there are widely held religious taboos that inhibit meat consumption. Approximately two-thirds of the people in this area are Hindu, most of whom consider meat, especially beef, unacceptable, and most of the remaining one-third are Moslem, for whom pork is proscribed.

Even though meat consumption in the past has been low, and is likely to remain so in the foreseeable future, coarse grain consumption would perhaps increase slightly if incomes rose. The level of caloric availability is deficient compared with nutritional standards that roughly represent the

Table 34.--Feed grain imports by South Asia,
by major source of imports, 1951-65

Year	Total <u>1/</u>	Developed nations			Communist Asia
		Total <u>1/</u>	United States	Australia,	
				New Zealand, and: South Africa	
----- 1,000 m.t. -----					
1951	1,004	633	621	12	366
1952	656	564	549	15	92
1953	193	175	141	34	---
1954	43	38	1	37	---
1955	2	2	---	2	---
1956	5	2	---	2	---
1957	44	1	---	1	---
1958	141	141	141	---	---
1959	137	137	136	1	---
1960	226	226	223	---	---
1961	158	148	144	4	---
1962	105	102	95	7	---
1963	77	74	73	1	---
1964	125	119	117	2	---
1965	227	226	226	---	---

1/ In some years, includes imports from areas not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 35.--Percentage of feed grain imports from
major sources by South Asia, 1951-65

Year	:	:	Developed nations			:
	Total <u>1/</u>	:	:	Australia,	Communist Asia	
		Total <u>1/</u>	United States	New Zealand, and: South Africa		
----- Percent <u>2/</u> -----						
1951	100.0	63.1	61.9	1.2	36.5	
1952	100.0	86.0	83.7	2.3	14.0	
1953	100.0	90.7	73.1	17.6	---	
1954	100.0	88.4	2.3	86.0	---	
1955	100.0	100.0	---	100.0	---	
1956	100.0	40.0	---	40.0	---	
1957	100.0	4.4	---	4.4	---	
1958	100.0	100.0	100.0	---	---	
1959	100.0	100.0	99.3	.7	---	
1960	100.0	100.0	98.7	1.3	---	
1961	100.0	93.7	91.1	2.5	---	
1962	100.0	97.1	90.5	6.7	---	
1963	100.0	96.1	94.8	1.3	---	
1964	100.0	95.2	93.6	1.6	---	
1965	100.0	99.6	99.6	---	---	

1/ In some years based upon data that included regions not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 36.--Supply distribution of coarse grains in South Asia, 1951-67

Year ending June 30	Production	Imports	Total supply	Exports	Disappearance	
					Total	Per capita
			1,000 m.t.			Kg.
1951.....	18,709	364	19,073	3	19,070	41
1952.....	19,516	978	20,494	1	20,493	44
1953.....	21,297	645	21,942	1	21,941	45
1954.....	25,393	148	25,541	1	25,540	52
1955.....	25,362	1	25,363	--	25,363	51
1956.....	22,254	8	22,262	--	22,262	44
1957.....	22,604	1	22,605	--	22,605	43
1958.....	24,495	13	24,508	--	24,508	46
1959.....	25,308	123	25,431	--	25,431	47
1960.....	25,167	70	25,237	--	25,237	46
1961.....	25,873	191	26,064	--	26,064	46
1962.....	25,245	78	24,323	--	25,323	44
1963.....	27,392	45	27,437	--	27,437	46
1964.....	26,224	76	26,300	--	26,300	43
1965.....	27,268	123	27,391	--	27,391	44
1966.....	23,741	1,102	24,843	--	24,843	39
1967.....	26,542	2,677	29,219	--	29,219	45

Table 37.--Estimated population of South Asia, 1966 and annual growth rate, 1950-65

Country	Population		Growth rate
	Number	Proportion of total	
	Million	Percent	Percent
India.....	498.7	76.3	2.2
Pakistan.....	117.0	17.9	2.4
Ceylon.....	11.6	1.8	2.6
Nepal.....	10.3	1.6	1.6
Afghanistan.....	15.4	2.3	1.9
Bhutan.....	.8	.1	1.9
Sikkim.....	.2	1/	1.7
Total.....	653.9	100.0	2.2

1/ Less than .05 percent.

physiological needs for normal health and activity for people living in South Asia. Under such circumstances, increases in income obviously would be used for food -- mostly grains, some of which might be coarse grains. Milk and eggs are acceptable in most diets, subject mainly to income constraints.

Because of the shortage of foreign exchange, over 90 percent of coarse grain imports since 1958 were from the United States, nearly all of which were under Public Law 480. Even shipments under Public Law 480 have been limited because of insufficient dock, transportation, and marketing facilities.

Changes in source of imports. -- There has been practically no change in source of imports since this area is so highly dependent upon the United States for concessional sales.

North Africa

During the early part of the 1950's, North Africa exported considerably more feed grain than it imported. By the mid-1960's, imports were about equal to exports. Most exports from this region went to the developed nations (tables 38 and 39). In the 1950's, this was particularly true, when the former French colonies exported considerable feed grains to France.

Production increases have been less than population increases, and the trend on per capita consumption has even been downward. One reason for the very slow growth in production was the loss in several countries of trained European farmers, through emigration at the time of the countries' independence, and a hesitance on those farmers remaining to invest time and money in farms that might be lost. Also, in Morocco, at least, many European farmers suffered because financing from France, which had been extended during the protectorate years, was withdrawn in 1956 (18). Under these conditions, it is not difficult to see why exports declined.

Southeast Asia

Thailand is the major exporting country in this region. In recent years, exports (mostly corn) from this country accounted for only about 3 percent of the world trade. However, the rate of growth in exports has been extremely high. The main reasons for this increase are believed to be an agricultural policy that has favored corn production and successive export contractual arrangements with Japan. Under these agreements, Japan has contracted in advance for a major portion of Thailand's export availabilities at favorable prices in relation to estimated production costs.

In addition, the Japanese have established overseas procure-and-import joint ventures in Thailand. This type of organization is illustrated by Japanese participation in the Bangkok Drying and Silo Company, an existing firm that reputedly is the largest grain elevator operation in Thailand. The enterprise is to roughly double its capitalization through investment participation by two of the largest Japanese trading firms, plus an overseas trading arm of Zenkoren, the cooperative that is Japan's largest animal feed manufacturer.

Table 38.--Feed grain exports by North Africa, by destination, 1951-65

Year	Total	Developed nations					Other Western Europe	Eastern Europe	Less developed nations
		Total	EEC	EFTA					
----- 1,000 m.t. -----									
1951	713	1/ 659	348	293		9		2	52
1952	653	608	423	185		---		---	43
1953	704	644	485	136		23		2	58
1954	733	697	602	83		12		17	19
1955	567	450	379	56		15		37	80
1956	700	597	555	39		3		5	98
1957	329	180	171	6		3		11	138
1958	457	377	306	60		11		40	40
1959	447	312	260	45		7		3	132
1960	414	282	181	86		15		---	132
1961	226	125	50	39		36		---	101
1962	125	76	54	15		7		---	49
1963	429	388	131	10		247		---	41
1964	380	313	115	10		188		30	37
1965	138	111	50	12		49		15	12

1/ Includes 9,000 metric tons exported to Japan.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 39.--Percentage of feed grain exported by North Africa, by destination, 1951-65

Year	Total	Developed nations						Eastern Europe	Less developed nations	
		Total	EEC	EFTA	Other Western Europe					
----- <u>Percent</u> 1/ -----										
1951	100.0	2/ 92.4	48.8	41.1	1.3	.3	7.3			
1952	100.0	93.1	64.8	28.3	---	.3	6.6			
1953	100.0	91.4	68.9	19.3	3.3	.3	8.2			
1954	100.0	95.1	82.1	11.3	1.6	2.3	2.6			
1955	100.0	79.3	66.8	9.9	2.6	6.5	14.1			
1956	100.0	85.3	79.3	5.6	.4	.7	14.0			
1957	100.0	54.7	52.0	1.8	.9	3.3	41.9			
1958	100.0	82.5	67.0	13.1	2.4	8.8	8.8			
1959	100.0	69.8	58.2	10.1	1.6	.7	29.5			
1960	100.0	68.1	43.7	20.8	3.6	---	31.9			
1961	100.0	55.3	22.1	17.3	15.9	---	44.7			
1962	100.0	60.8	43.2	12.0	5.6	---	39.2			
1963	100.0	90.4	30.5	2.3	57.6	---	9.6			
1964	100.0	82.4	30.3	2.6	49.5	7.9	9.7			
1965	100.0	80.4	36.2	8.7	35.5	10.9	8.7			

1/ Percentages may not add to 100 due to rounding.

2/ Includes exports to Japan not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

The objective is to keep up with commercial competition in Thailand by expediting collection of corn from the countryside and by improving terminal facilities near Bangkok for corn export, principally to Japan.

Furthermore, produce-and-import joint ventures have been established by Japan in several countries in Southeast Asia. Among other activities, these ventures are to initiate commercial corn production where little or none was produced before. Two such companies are the Cambodian Tropical Crop Corporation and the Lampung Development Company, established to invest in joint Japanese-Indonesian enterprises near Lampung, Sumatra. These organizations are joint ventures in that they are jointly owned by (1) the Cambodian (or Indonesian) Government and (2) various business interests in Japan

World Developments

Between 1951 and 1965, international trade for coarse grains grew by 1.7 million metric tons, or well over 7 percent a year on a trend basis, reaching a total of 38 million tons by 1965. By far, the largest market was the Common Market, with imports increasing 790,000 metric tons a year, or 8.8 percent (tables 40 and 41). The EEC took between 30 and 40 percent of world trade during the period. Other European nations and Japan were also important markets; the central plan nations and the less developed nations typically imported only 15 to 20 percent of world totals.

The largest exporter, by far, was the United States, with exports increasing a million metric tons a year from 1951-65. It exported more than 40 percent of the world total in every year after 1958 and exported more than twice as much as all less developed nations together in many years (tables 42 and 43). Canada's importance as an exporter dropped significantly during the period under study. In 1951-53, it was the second largest exporter, supplying about one-fifth of the market. In 1963-65, it ranked seventh in importance among the regions in this report. It exported only 4 percent of the total, and its exports were on a downward trend in the international market, which was increasing rapidly. Latin America, especially Argentina, but also Mexico and Brazil, increased its exports from around 1.4 million metric tons in 1951-53 to about 4.8 million metric tons, increasing its share of the market from 10 to 14 percent.

Also increasing its importance as an exporter was the Common Market. Its average share of the market in 1951-53 was only 1.3 percent, but by 1963-65, it had 11 percent of the market. The quantity of exports increased from 187,000 metric tons to 3,833,000 metric tons, which made it the fastest growing exporting region in the world.

The United States is the largest consumer and producer of coarse grains, as well as exporter (tables 44 and 45). According to the best available data, the United States consumed about one-fourth of the world coarse grain consumption in 1964-66. The United States produced about 29 percent of the world total.

The demand for coarse grains can be divided into three markets: direct human consumption, feed for livestock, and industrial use. On a per capita

Table 40.--Feed grain imports, by major importers, 1951-65

Year	Developed nations										Less developed nations				
	Total 1/	EEC	United Kingdom	Other Western Europe 2/	Japan	Eastern Europe	Total 1/	Latin America	West Asia	South Asia					
----- 1,000 m.t. -----															
1951	13,556	11,522	4,560	2,455	2,130	1,023	299	1,735	211	130	1,004				
1952	15,015	12,688	5,166	2,797	2,010	1,011	833	1,494	95	124	656				
1953	15,559	12,956	4,635	3,062	1,629	895	1,087	1,516	529	168	193				
1954	15,927	13,292	6,147	2,473	2,274	976	2,000	619	238	131	43				
1955	15,249	12,763	5,402	2,889	2,655	1,019	1,458	758	165	331	2				
1956	19,479	15,991	8,088	2,827	2,654	1,307	2,278	1,158	316	193	5				
1957	18,995	14,330	6,948	2,800	1,988	1,371	2,479	2,127	1,077	363	44				
1958	21,478	17,164	7,770	4,371	2,651	1,384	1,503	2,312	1,088	405	141				
1959	22,475	19,310	8,822	4,760	3,524	1,430	1,778	1,377	281	500	137				
1960	23,611	19,982	9,901	4,162	3,300	1,402	1,944	1,689	376	578	226				
1961	25,677	20,276	9,376	4,565	3,017	2,100	1,360	2,560	408	558	158				
1962	32,953	26,547	13,434	5,728	3,589	2,732	2,882	2,522	585	637	105				
1963	31,431	25,533	13,082	4,212	3,930	3,589	2,980	2,880	994	761	77				
1964	34,162	27,899	13,277	4,127	4,921	4,756	2,930	2,785	932	551	125				
1965	38,303	32,016	16,548	4,112	5,574	5,626	3,429	2,679	634	677	227				

1/ In some years, includes data for regions not shown separately.

2/ Other Western Europe. Includes all European nations except the United Kingdom and the members of the Common Market.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 41.--Percentages of world feed grain imported, by major importers, 1951-65

Year	Developed nations										Less developed nations			
	Total 1/	Total 1/	EEC	United Kingdom	Other Western Europe 2/	Japan	Eastern Europe	Total 1/	Latin America	West Asia	South Asia			
1951	100.0	84.9	33.6	18.1	15.7	7.5	2.2	12.8	1.6	1.0	7.4			
1952	100.0	84.5	34.4	18.6	13.4	6.7	5.5	1.0	.6	.8	4.4			
1953	100.0	83.3	29.8	19.7	10.5	5.7	7.0	9.7	3.4	1.1	1.2			
1954	100.0	83.5	35.6	15.5	14.2	6.1	1.3	3.9	1.5	.8	.3			
1955	100.0	83.7	35.4	18.9	17.4	6.7	9.6	5.0	1.1	2.2	.1			
1956	100.0	82.1	41.5	14.5	13.6	6.7	11.7	5.9	1.6	1.0	.1			
1957	100.0	75.4	36.6	14.7	10.4	7.2	13.1	11.2	5.7	1.9	.2			
1958	100.0	80.0	36.2	20.4	12.3	6.4	7.0	10.8	5.1	1.9	.7			
1959	100.0	85.9	39.3	21.2	15.7	6.4	7.9	6.1	1.3	2.2	.6			
1960	100.0	84.6	41.9	17.6	14.0	5.9	8.2	7.6	1.6	2.4	1.0			
1961	100.0	79.0	36.5	17.8	11.7	8.2	5.3	1.0	1.6	2.2	.6			
1962	100.0	80.6	40.8	17.4	10.9	8.3	8.7	7.7	1.8	1.9	.3			
1963	100.0	81.2	41.6	13.4	12.5	11.4	9.5	9.2	3.2	2.4	.2			
1964	100.0	81.7	38.9	12.1	14.4	13.9	8.6	8.2	2.7	1.6	.4			
1965	100.0	83.6	43.2	10.7	14.6	14.7	9.0	7.0	1.7	1.8	.6			

1/ In some years, based upon data that included regions not shown separately.

2/ Other Western Europe. Includes all European nations except the United Kingdom and the members of the Common Market.

3/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 42.--Feed grain exports by major exporters, 1951-65

Year	Developed nations					Less developed nations				
	Total 1/	United States	EEC	Canada	Australia, New Zealand, and South Africa	Eastern Europe	USSR	Total 1/	Latin America	Southeast Asia
1951	13,556	8,793	5,629	127	2,069	684	269	1,181	2,662	1,036
1952	15,015	9,127	4,463	216	3,214	669	1,070	1,487	3,212	1,410
1953	15,559	10,187	4,358	218	4,312	835	653	867	3,781	1,811
1954	15,927	7,264	2,553	401	2,341	1,270	1,031	1,058	6,547	4,517
1955	15,249	10,002	5,900	600	1,950	1,072	791	1,127	3,322	1,807
1956	19,479	12,429	6,891	956	2,002	1,813	1,069	1,772	4,178	2,097
1957	18,995	12,394	6,264	2,194	1,934	1,690	706	2,306	3,552	2,185
1958	21,478	14,056	8,996	639	2,059	1,628	1,364	1,032	4,988	3,136
1959	22,475	15,654	11,000	565	1,724	1,790	720	1,335	4,602	3,113
1960	23,611	14,684	10,085	1,276	1,385	1,327	1,394	1,538	5,862	4,477
1961	25,677	18,240	10,362	3,448	1,446	2,374	1,587	1,656	4,190	2,685
1962	32,953	22,779	15,546	1,839	976	3,240	1,260	2,692	6,209	4,081
1963	31,431	21,956	14,496	2,581	1,169	2,920	1,501	2,243	5,730	3,556
1964	34,162	24,319	15,428	4,429	1,639	2,258	1,348	1,307	6,990	4,872
1965	38,303	26,351	18,542	4,488	1,363	1,128	1,368	2,582	7,748	5,872

1/ In some years, includes data for regions not shown separately.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 43.--Percentages of world feed grain exports, by major exporters, 1951-65

Year	Developed nations				Central plan nations				Less developed nations			
	Total 1/	United States	EEC	Australia, New Zealand, and South Africa	Canada	USSR	Europe	Latin America	Southeast Asia	West Asia		
1951	100.0	64.9	41.5	.9	15.3	5.0	2.0	8.7	19.6	7.6	.3	4.9
1952	100.0	60.8	29.7	1.4	21.4	4.5	7.1	10.0	21.4	9.4	.5	5.2
1953	100.0	65.5	28.0	1.4	27.7	5.4	4.2	5.6	24.3	11.6	.2	6.7
1954	100.0	45.6	16.0	2.5	14.7	8.0	6.5	6.6	41.1	28.4	.5	6.3
1955	100.0	65.6	38.7	3.9	12.8	7.0	5.2	7.4	21.8	11.9	1.0	3.1
1956	100.0	63.8	35.4	4.9	10.3	9.3	5.5	9.1	21.4	10.8	1.0	4.0
1957	100.0	65.3	33.0	11.6	10.2	8.9	3.7	12.1	18.7	11.5	1.1	2.5
1958	100.0	65.4	41.9	3.0	9.6	7.6	6.4	4.8	23.2	14.6	1.2	2.9
1959	100.0	69.6	48.9	2.5	7.7	8.0	3.2	5.9	20.5	13.8	1.2	1.5
1960	100.0	62.2	42.7	5.4	5.9	5.6	5.9	6.5	24.8	19.0	2.4	.3
1961	100.0	71.0	40.4	13.4	5.6	9.2	6.2	6.5	16.3	10.5	2.8	.6
1962	100.0	69.1	47.2	5.6	3.0	9.8	3.8	8.2	18.4	12.4	1.8	2.4
1963	100.0	69.9	46.1	8.2	3.7	9.3	4.8	7.1	18.2	11.3	2.5	1.6
1964	100.0	71.2	45.2	13.0	4.8	6.6	3.9	3.8	20.5	14.3	3.1	1.1
1965	100.0	68.8	48.4	11.7	3.6	2.9	3.6	6.7	20.2	15.3	2.7	1.2

1/ In some years, based upon data that includes areas not shown separately.

2/ Percentages may not add to 100 due to rounding.

Source: U.S. Dept. Agr., For. Agr. Econ. Rpt. 45, Vol. II.

Table 44.--Coarse grain consumption in 22 regions, average 1964-66

Region or country	Consumption	
	Amount	Percentage of total
	1,000 m.t.	Pct.
United States	124,492	26.2
Soviet Union	51,270	10.8
Communist Asia	46,843	9.8
Eastern Europe	44,354	9.3
EEC	43,009	9.0
South Asia	27,151	5.7
Other Western Europe	24,911	5.2
Canada	13,501	2.8
United Kingdom	13,002	2.7
East Africa	12,208	2.6
East South America	11,314	2.4
West Africa	11,059	2.3
Central America	10,470	2.2
West Asia	8,767	1.8
East Asia and Pacific Islands	6,751	1.4
North Africa	6,486	1.4
Japan	6,389	1.3
South African Republic	4,646	1.0
Argentina	3,871	.8
West South America	2,877	.6
Australia and New Zealand	2,369	.5
Southeast Asia	187	1/
Total	475,927	100.0
1/ Less than .05.		

Table 45.--Coarse grain production in 22 regions, average 1964-66

Region or country	Production	
	Amount	Percentage of total
	----- 1,000 m.t. -----	Pct. 1/ -----
United States	136,619	29.1
Soviet Union	51,575	11.0
Communist Asia	46,940	10.0
Eastern Europe	43,972	9.3
EEC	30,862	6.6
South Asia	28,850	5.5
Other Western Europe	19,380	4.1
Canada	14,085	3.0
East Africa	12,095	2.6
East South America	11,551	2.5
Central America	11,128	2.4
West Africa	11,121	2.4
United Kingdom	9,494	2.0
Argentina	8,977	1.9
West Asia	8,307	1.8
East Asia and Pacific Islands	6,422	1.4
North Africa	6,390	1.4
South African Republic	5,108	1.1
Australia and New Zealand	3,141	.8
West South America	2,788	.6
Japan	1,440	.3
Southeast Asia	1,438	.3
Total	468,783	100.0

1/ Percentages may not add to 100 due to rounding.

basis, the demand for coarse grain is limited when used for direct consumption. The maximum is about 160 kilograms consumed in Rhodesia and Nyasaland (1960-62 average). In countries where incomes do not permit the purchase of meat and other high-quality foods, wheat and rice are often, though not always, consumed in preference to coarse grains. In the United States, Canada, and other nations with high standards of living, use of coarse grains is over 600 kilograms per capita per year. In "meatless" countries, population will be the primary factor determining the demand for coarse grains (or at least coarse grain requirements since many people in some nations are not in the world monetary economy).

In most countries, incomes are increasing --at a slow rate if not at a rapid one. As incomes increase in very poor countries, the quantity of coarse grains consumed on a per capita basis will increase. The people in these countries are receiving less calories than they would like and, in short, they are hungry. As incomes increase, the quantity of coarse grains consumed increases but a point is reached where all the calories needed in life can be purchased. Attention is then diverted from the quantity of food to the quality of the diet. At this point, religion permitting, the quantity of meat is increased in meaningful amounts or is introduced into the diet. Feed grain use accelerates as meat is consumed, and use continues to increase until very high levels of income are reached. At some level, however, not even additional quantities of meat are desired.

In most nations today, the average income is below the level where no more meat is desired. Even in nations where the average income is at such a level, there are many people earning incomes below that level. If the median income is used as a measure of "average" income (as is most often done in the United States) and if it is assumed that the median is just at a level where the income elasticity for meat is zero, then half the population is consuming less meat than they desire. Thus, there is room for expansion of coarse grain use even in high-income countries.

In these countries, the rate of population growth becomes an important variable. Each addition to the population represents a demand factor for coarse grains three or four times greater than that of an additional person in a less developed nation.

The industrial uses of coarse grains include grain used as seed, waste, and as a raw material for production of alcoholic beverages, starch, vegetable oils, and various other manufactured products. Because of the heterogeneity of uses, it is extremely difficult to analyze the factors that influence demand. It is assumed throughout this report that they would not be too different from those related to coarse grains used as livestock feed. Fortunately, industrial use of grains, while important, is not a major use.

As is true of most basic commodities, other commodities become competitive with coarse grains if the relative price of these grains becomes too high. To some extent, soybeans have become competitive with coarse grains, although, for technical reasons, there are limits on how far this substitution can take place. In the 1950's and 1960's, a number of countries adopted farm policies that emphasized the production of wheat. The goal of such policies, among other things, was to become less dependent upon imports as a source of the national

food supply or to become completely independent of them. As a result of these policies, not a few countries have become surplus wheat producers. This reduces the market for coarse grains in one of two ways. Wheat is either fed to livestock as feed or acreage is diverted to coarse grain production. Most likely, these two practices complement, rather than substitute for, each other. The feeding of wheat to livestock is more a short-term solution, and diversion of acreage, a long-term one. It is interesting to note that, in Spain, after wheat became a surplus commodity, farmers were very reluctant to feed it to cattle since for many generations wheat had been a scarce commodity.

In several countries, milk and other dairy products have become surplus items. This situation creates pressure to reduce cow herds and thereby, coarse grain requirements. In such cases, however, dairy cows may be replaced with beef cattle and the need for coarse grains pushed to a level higher than before.

The trend on the price of wheat in the world market is important in determining the feasibility of starting or increasing coarse grain production by less developed nations. Most nations that are wheat exporters are capable of switching from wheat to coarse grain production. With declining world wheat prices, as has been the case in recent years, there would be strong pressure to do so. However, if comparative advantage remains with wheat, feeding of this grain to livestock may increase.

Since 1950, the number of draft animals on farms has been declining, and this decline has often led to a reduction in oats production. As incomes increased, Europeans, but not Americans, have consumed less rye bread, thereby reducing rye production. The acreage taken out of oats and rye has been replaced with barley and corn. The yields from barley and corn are often higher than the other two coarse grains, although in very cold climates with short growing seasons, oats are more productive. Such conditions exist, for example, in Sweden and Finland. Corn has the greatest yield in the warmest climates if there is sufficient water. With this in mind, efforts are being made to develop varieties that can be used in latitudes farther from the equator, especially in the northern hemisphere. In climates where corn cannot be substituted for rye and oats, barley is often substituted.

In general, farmers of developed nations are becoming very technically competent, and the amount of farm technology is increasing. This increased technology obviously increases farm production, and fewer farmers are needed. However, even when farmers leave the land it most often remains in production, and thus, production rarely declines. This is true not only in the United States but in Europe and other areas. The United States has gone to considerable effort to retire land or restrict the acreage farmers could use. Such restrictions have not been placed upon farmers elsewhere; thus, the supply of coarse grains has increased and prices have declined. An expansion in livestock production -- especially poultry and pork -- has increased the demand for such grains, but not enough to keep prices up.

In nations with high income, population typically has not grown rapidly. Conversely, in nations with rapid population growth, incomes have not been high. These situations further explain a lack of more rapid growth in demand.

World peace will permit attention to be devoted to increasing world food production. However, because of memories of wars not too distant in history, many nations still fear depending too heavily upon imports for their food supply. In some nations, the fear of international sanctions promotes greater self-reliance. Furthermore, farmers in many highly developed nations are a strong political force. For any or all of these reasons, agriculture is most often a protected industry, with prices set high and imports restricted.

Although these and other factors have driven down international prices, the quantity of barley and corn entering world trade between 1947 and 1964 was of such magnitude that foreign exchange earnings increased on a trend basis. Unfortunately, from the viewpoint of the less developed nations, they exported only 11 percent of the barley and 29 percent of the corn (16). Whether the production and exportation of feed grains is a viable undertaking for less developed nations depends upon the rate of growth in income and feed grain production in highly developed nations and the cost of production in each less developed nation. These rates and costs are the things that must be quantitatively estimated.

THE MAIN SEQUENCE OF DEVELOPMENT IN THE WORLD GRAIN-LIVESTOCK ECONOMY

Background and Methodology

The countries and regions of the world tend to fall into a main sequence of economic development -- an economic classification scheme -- when classified by per capita income and other criteria. Some aspects of the production and consumption of agricultural commodities provide other measurable indicators of the development process.

In the development sequence, limitations on use of available resources are imposed differently in societies at the threshold of survival or starvation compared with those in more advanced stages of affluence. Successively higher levels of income and wealth provide a continuum in the patterns of resource allocations, one that can be quantified.

At the lowest level of income, most commodities capable of being used as food are consumed by man, if they can be obtained. Nearly all grain is used as food. Livestock must scavenge or graze. They cannot be fed with commodities eligible for use as human food, since this is too costly. Nor can these scrawny, ill-nourished animals be casually slaughtered for food, since they represent too much wealth alive.

With advancing affluence from this extremely low level, increasing amounts of grain can be spared for livestock. Feed grain appears as a socially identifiable commodity. The demand for meat comes to vie with the demand for bread in determining grain allocation. Poor societies can divert little feed grain from the food production process. Rich societies reserve a small portion for food and allocate the bulk of their grain supplies to livestock.

In table 46, some basic indicators of production and consumption in the world grain-livestock complex are presented, along with income and population. Attention is focused on meat consumption, human grain consumption, grain used per unit of meat produced, and the share of feed grain in total grain use.

Major emphasis is given to the study of the quantity of grain used per unit of meat produced, identified in table 46 as the grain-meat ratio. The method of estimating this ratio has been to prepare production-trade-utilization tables by country and by world regions for two commodity categories: (1) cereal grain and (2) meat. The feed grain consumption item in the cereal grain balance is then divided by the meat production item in the meat balance. World quantity and percentage distributions of the following balance items, by type of grain or kind of livestock, were also prepared to assist in interpreting the calculated ratios:

- Livestock production
- Distribution of grain utilization
- Grain consumption by livestock
- Grain production
- Self-sufficiency in grain
- Self-sufficiency in meat

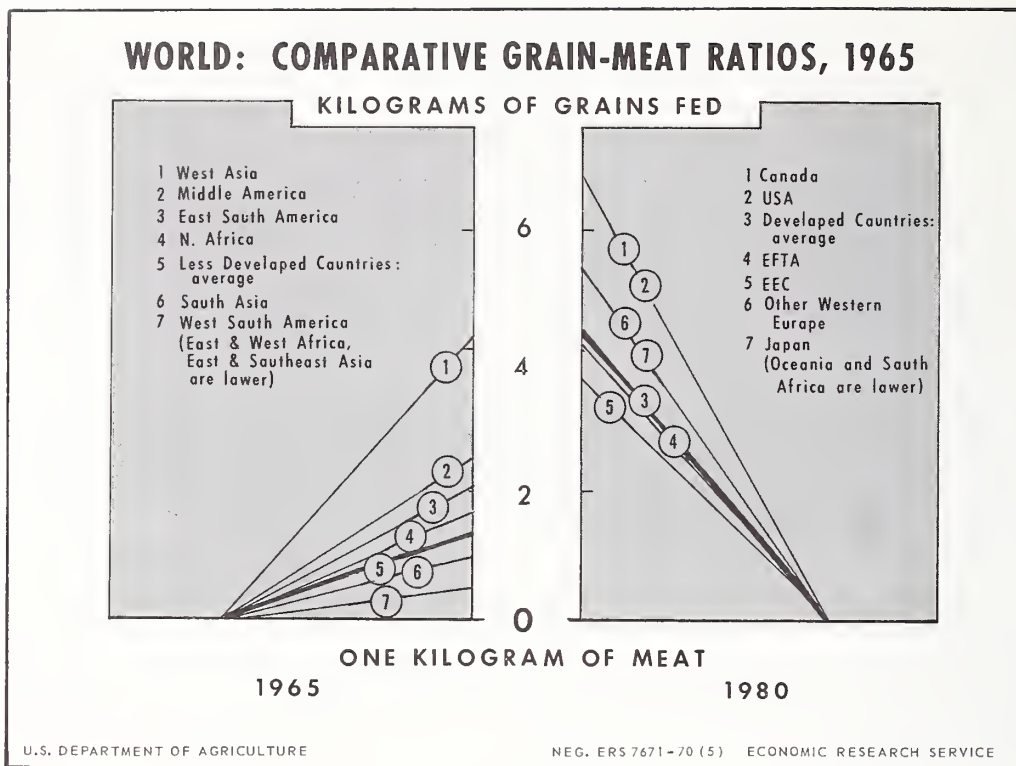


Figure 9

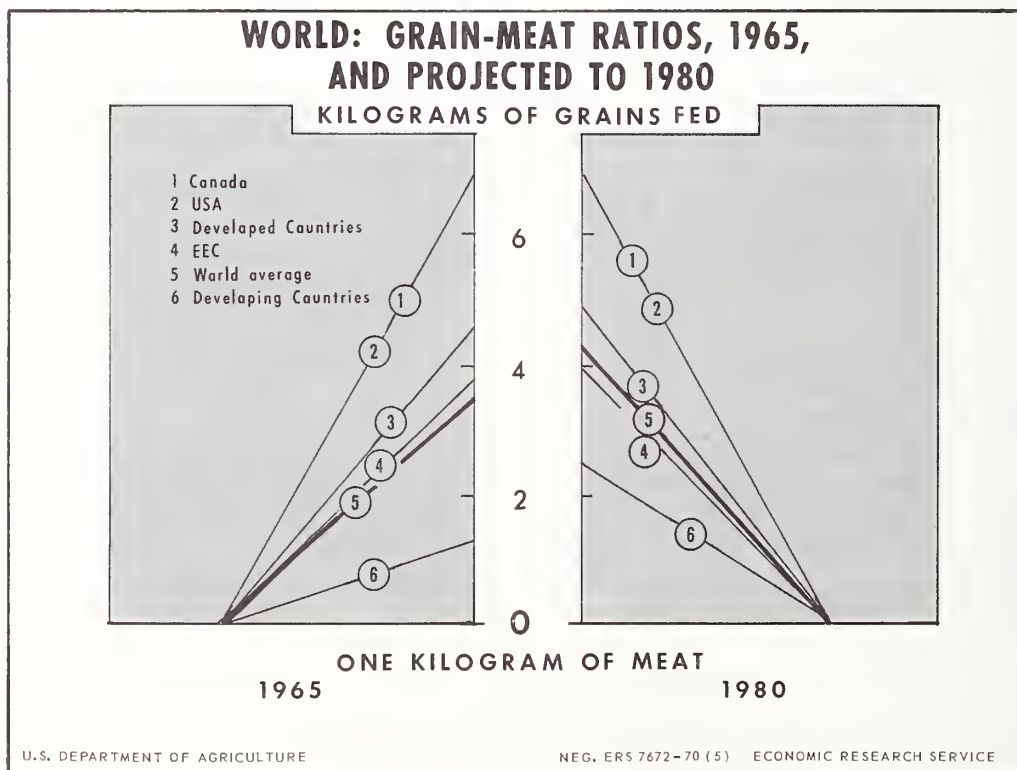


Figure 10

The derivation of the grain-meat ratio, together with related commodity balances and distribution tables, will be found in the appendix tables.

The method of analysis was to estimate a series of cross-sectional functions for the world by use of multiple-regression least squares. For these computations, the world was considered as an entity divided into population districts of 10 million persons each. The United States, with a population of 186.6 million in 1962, contains 19 such population districts; Canada is represented by two population districts; France, Germany, and Italy, five each; Belgium and the Netherlands, one each; India, 45; and so on, to a world total of 307 population districts. Fractional population districts are not allowable; one observation in the regression calculation is assigned to each district. Thus, a region having one assigned population district may have a 1962 population ranging between 5 million and 15 million. Among the many one-district countries, a deliberate selection was necessary to include those that preserved approximate representativeness both within the region and at the world level. The countries included in the calculations are listed in table 46, together with their regression weights shown as the number of population districts. Parentheses indicate subtotals, not observations. The countries and regions into which the world was organized for this strategy are set forth in the appendix list. In general, regions comprise groups of countries, but some regions contain only one country.

The most recent year for which reasonably comprehensive data are available for providing a quantified, analytical description of the world grain-livestock economy is 1962. Most of the figures are from sources developed by the Food and Agricultural Organization of the United Nations (FAO) in connection with the Indicative World Plan for Agricultural Development, a plan designed to encompass 1965-85, and the Organization for Economic Cooperation and Development (OECD). FAO has authored the publication *Agricultural Commodities Projections for 1975 and 1985* and has devoted its analytical resources to the problems of the less developed countries. OECD prepares its yearbooks *Food Consumption Statistics of the developed countries* and provides FAO with developed country data for its comprehensive world projections. Data from these two principal sources for 1962, with, where possible, use of annual averages and percentages based on a span of years, were supplemented and augmented by estimates provided by the Foreign Agricultural Service and the Economic Research Service, USDA, and, on occasion, estimates for other dates were used. Thus, the figures shown in the accompanying tables represent compromises used to obtain as comprehensive as possible an array of internationally comparable detail on grain and livestock production and consumption. The totals at regional and world levels, therefore, should be taken as suggesting orders of magnitude and not as constituting revision of formerly published official estimates of USDA or other organizations.

Meat Consumption

For the world, the average annual consumption of meat in 1962, according to data described in the foregoing section, was 24.9 kilograms per capita. In the developed countries, it averaged 59.3 kilograms, in central plan countries, 21.9 kilograms, and in less developed countries, 10.6 kilograms.

Table 46.--World: Population, per capita income, selected food consumption indicators and price ratios, and the grain-meat ratio, by country or region, "1962" 1/

Region or country	: Identifi- cation code	: Population: districts	: Income per capita	: Price Ratio		: Human consumption per capita				: Grain-meat ratio		: Feed consump- tion share as percentage of disappearance
				: Meat to: wheat	: Meat to: grain	: Calories per day	: Protein per day		: Meat percentage of total	: Grain		
							: Total	: Animal as				
				: --	: Percent	: Units	: Grams	: Percent	: -- Kilograms --		: Kg. grain per kg. meat	: Percent
		: Units of 10 million	: Dollar equiv.	: (6.43)	: (8.41)	: (2,907)	: (85.7)	: (53.6)	: (59.3)	: (98.0)	: (4.59)	: (61.7)
Developed countries	DEV	(64)	(1,475)									
United States	USA	19	2,684	5.75	10.42	3,100	91.2	70.5	89.5	66.0	5.55	77.7
Canada	CAN	2	1,787	5.75	10.42	3,017	91.3	66.2	76.6	66.3	6.94	70.6
European Community	EEC	(17)	(1,123)	(7.55)	(7.87)	(2,906)	(87.0)	(52.6)	(58.3)	(102.0)	(4.11)	(54.3)
Belgium-Luxembourg	BEL	1	1,255	7.55	7.87	3,039	85.3	53.7	60.4	89.7	3.94	58.9
Netherlands	NTH	1	1,027	7.55	7.87	2,951	78.0	58.7	45.9	80.4	4.76	72.1
France	FRA	5	1,314	7.55	7.87	2,945	103.0	57.7	85.9	99.5	3.29	59.9
Germany, West	GER	5	1,338	7.55	7.87	2,964	80.3	61.3	60.5	79.2	3.33	54.9
Italy	ITA	5	699	7.55	7.87	2,743	80.0	37.3	30.7	134.2	5.63	40.8
EFTA	EFT	(10)	(1,210)	(7.55)	(7.87)	(3,148)	(89.1)	(57.7)	(60.8)	(88.3)	(4.32)	(60.1)
Austria	AUS	1	886	7.55	7.87	2,974	86.8	54.7	59.8	103.9	3.53	52.4
Denmark	DEN	1	1,381	7.55	7.87	3,369	93.5	62.0	66.3	77.9	4.61	78.8
Portugal	POR	1	285	7.55	7.87	2,548	92.6	37.5	19.7	126.1	1.84	16.2
Sweden	SWD	1	1,689	7.55	7.87	2,989	82.7	65.7	51.2	71.9	6.28	69.1
Switzerland	SWI	1	1,738	7.55	7.87	3,222	90.3	56.8	59.9	96.0	3.65	47.1
United Kingdom	UK	5	1,305	7.55	7.87	3,276	89.0	60.0	70.3	81.4	4.65	58.6
Other Western Europe	OWE	(4)	(365)	(7.55)	(7.87)	(2,853)	(81.7)	(30.8)	(22.1)	(126.5)	(5.42)	(39.7)
Greece	GRC	1	406	7.55	7.87	2,974	95.3	32.1	25.5	158.7	3.30	24.8
Spain	SPN	3	354	7.55	7.87	2,812	77.1	30.4	20.9	115.8	6.13	38.5
Japan	JAP	9	521	4.80	6.27	2,228	69.1	24.5	6.4	149.2	5.49	18.6
South African Republic	SAF	2	480	4.59	6.38	2,820	80.4	39.3	44.5	166.5	1.35	20.1
Oceania	OCN	1	1,505	4.59	6.38	3,136	89.8	66.5	110.0	83.6	.55	38.6
Central plan countries	PLN	(107)	(310)	(5.67)	(6.78)	(2,386)	(67.7)	(18.7)	(21.9)	(157.0)	(3.60)	(22.0)
Soviet Union	USR	22	820	7.55	7.87	2,998	85.9	33.8	37.5	171.4	3.35	25.2
Eastern Europe	EEU	(12)	(626)	(7.55)	(7.87)	(3,005)	(78.7)	(37.0)	(40.8)	(155.4)	(6.58)	(47.8)
Bulgaria	BUL	1	553	7.55	7.87	2,911	81.2	20.0	23.4	202.4	9.75	41.2
Czechoslovakia	CZH	1	750	7.55	7.87	3,093	70.4	46.4	53.1	126.8	6.39	52.6
Germany, East	CDR	2	1,083	7.55	7.87	3,037	65.6	48.9	55.3	103.2	4.49	52.0
Hungary	HUN	1	657	7.55	7.87	2,896	71.4	44.5	54.5	136.5	7.49	62.0
Poland	POL	3	594	7.55	7.87	3,103	78.0	43.8	44.7	141.6	5.55	47.0
Romania	ROM	2	550	7.55	7.87	2,836	81.1	25.9	28.5	194.3	6.22	36.3
Yugoslavia	YUG	2	254	7.55	7.87	3,050	96.9	26.3	28.4	189.4	8.64	46.6
Communist Asia	CHN	73	105	4.80	6.27	2,100	60.4	11.1	14.1	152.9	1.58	5.5

Note: see footnote at end of table.

Continued--

Table 46.--World: Population, per capita income, selected food consumption indicators and price ratios, and the grain-meat ratio, by country or region, "1962" I/--continued

Region or country	Identifi- cation code	Population districts	Income per capita	Price ratio		Human consumption per capita				Grain-meat ratio	Feed consump- tion share as percentage of disappearance	
				Meat to: wheat	Meat to: grain	Calories per day	Protein per day	Total percentage of total	Meat percentage			Grain
Units of 10 million	Dollar equiv.	-- Percent --	Units	Grams	Percent	-- Kilograms --	Percent	Kg. grain per kg. meat	Percent			
Less developed countries	LDC	(136)	(130)	(3.91)	(6.27)	(2,181)	(55.5)	(18.8)	(10.6)	(133.8)	(1.30)	(8.0)
Middle America	CAM	(7)	(307)	(4.59)	(8.06)	(2,362)	(64.1)	(27.3)	(17.8)	(126.8)	(2.51)	(20.3)
Mexico	MEX	4	367	5.75	10.42	2,599	70.9	31.2	22.1	127.5	2.41	20.5
El Salvador	SAL	1	222	3.04	4.92	2,026	56.6	26.5	13.0	128.9	2.94	20.3
Guatemala	GTM	1	256	3.04	4.92	2,036	54.5	16.0	12.4	141.4	1.55	8.3
Honduras	HON	1	201	3.04	4.92	2,081	53.7	23.6	11.0	107.1	3.45	26.6
East-South America	ESA	(11)	(279)	(3.04)	(4.92)	(2,746)	(68.3)	(35.0)	(40.5)	(104.1)	(2.07)	(36.3)
Argentina	ARG	2	445	3.04	4.92	2,816	81.6	64.2	99.6	91.1	1.08	42.3
Brazil	BRZ	8	154	3.04	4.92	2,777	66.3	27.1	27.5	108.9	2.53	35.6
Venezuela	VEN	1	949	3.04	4.92	2,357	58.2	40.0	26.1	91.7	.38	8.5
West-South America	WSA	(4)	(309)	(3.04)	(4.92)	(2,222)	(58.1)	(39.5)	(32.9)	(74.6)	(.62)	(11.9)
Chile	CHL	1	453	3.04	4.92	2,412	77.2	35.4	33.3	64.6	1.26	17.4
Colombia	COL	2	270	3.04	4.92	2,161	48.7	45.6	35.9	69.1	.40	12.7
Peru	PRU	1	241	3.04	4.92	2,155	57.6	31.3	26.3	95.7	.42	7.1
North Africa	NAF	(7)	(153)	(3.87)	(6.61)	(2,235)	(65.7)	(19.7)	(12.0)	(146.2)	(1.72)	(9.2)
Algeria	ALG	1	245	4.16	7.00	2,326	63.0	19.4	7.9	156.8	2.07	8.0
United Arab Republic	UAR	3	135	3.48	6.08	2,391	69.9	14.4	9.6	165.3	1.10	5.0
Morocco	MOR	1	150	4.16	7.00	2,207	66.4	23.3	13.4	139.1	4.40	22.9
Sudan	SDN	1	93	4.16	7.00	2,034	69.3	32.9	25.1	113.3	.03	.4
Tunisia	TUN	1	180	4.16	7.00	1,903	51.8	18.9	18.9	118.8	2.23	14.3
West Africa	WAF	(9)	(111)	(4.16)	(7.00)	(2,241)	(56.8)	(13.3)	(9.3)	(108.5)	(.14)	(.6)
Cameroon	CMR	1	75	4.16	7.00	2,223	50.9	15.5	9.0	82.3	.32	3.7
Ghana	GHN	1	216	4.16	7.00	2,115	46.3	15.6	6.7	78.7	.08	.6
Ivory Coast	IVC	1	175	4.16	7.00	2,115	46.3	15.6	6.7	78.7	.10	.4
Nigeria	NIG	5	73	4.16	7.00	2,305	59.7	10.9	110.4	113.9	.15	.7
Senegal	SEN	1	172	4.16	7.00	2,180	68.8	18.2	9.4	167.2	.03	.2
East Africa	EAF	(8)	(85)	(4.16)	(7.00)	(2,201)	(61.3)	(20.2)	(17.6)	(130.6)	(.35)	(3.1)
Ethiopia	ETH	2	44	4.16	7.00	2,108	71.1	27.4	26.9	148.5	.38	3.7
Kenya	KNY	1	79	4.16	7.00	2,220	69.0	22.8	21.1	120.8	.53	5.7
Malagasy	MLG	1	88	4.59	6.38	2,216	48.2	16.6	15.3	159.3	.15	1.1
Rhodesia	RHO	1	214	4.16	7.00	2,319	60.5	17.2	16.4	137.2	.14	4.5
Tanzania	TNZ	1	63	4.16	7.00	2,110	57.9	12.6	10.9	125.2	.47	3.6
Uganda	UGN	1	65	4.16	7.00	2,243	54.4	19.1	10.0	61.1	.17	1.6
Zambia	ZMB	1	86	4.16	7.00	2,281	58.5	18.2	13.2	114.2	.29	1.2

Note: see footnote at end of table.

Continued--

Table 46.--World: Population, per capita income, selected food consumption indicators and price ratios, and the grain-meat ratio, by country or region, "1962" 1/--continued

Region or country	Identifi- cation code	Population districts	Income per capita	Price ratio		Human consumption per capita				Grain-meat ratio	Feed consump- tion share as percentage of disappearance
				Meat to: wheat	Meat to: grain	Calories per day	Protein per day	Animal as			
								Total : of total :	Meat : :		
			Dollar equiv.	-- Percent --	Units	Grams	Percent	-- Kilograms --	kg. meat	Percent	
West Asia	WAS	(8)	(224)	(5.01)	(6.75)	(2,328)	(71.2)	(22.9)	(17.8)	(150.6)	(22.7)
Iran	IRN	2	193	3.48	6.08	2,054	59.7	22.4	15.9	143.8	11.6
Iraq	IRQ	1	273	3.48	6.08	2,143	61.9	28.4	20.1	129.6	23.9
Lebanon	LBN	1	314	3.48	6.08	2,426	68.3	28.0	32.2	121.6	.75
Syria	SYR	1	182	3.48	6.08	2,343	68.1	17.9	14.0	157.6	8.1
Turkey	TUR	3	212	7.55	7.87	2,534	83.9	21.3	14.8	169.4	30.7
South Asia	SAS	(59)	(76)	(3.48)	(6.08)	(2,034)	(51.3)	(13.8)	(2.2)	(143.3)	(.9)
Afghanistan	AFG	2	60	3.48	6.08	2,077	70.4	22.4	13.4	173.8	.63
Ceylon	CEY	1	129	3.48	6.08	2,080	44.4	18.0	2.1	127.3	.12
India	IND	45	78	3.48	6.08	2,017	51.5	11.7	1.4	139.5	1.1
Pakistan	PAK	11	76	3.48	6.08	2,090	47.8	20.7	3.5	154.7	.21
East Asia-Pacific Islands	EAS	(18)	(96)	(4.80)	(6.27)	(2,126)	(46.3)	(17.2)	(7.2)	(131.3)	(2.3)
Indonesia	NDN	10	69	4.80	6.27	2,156	43.3	11.5	5.7	119.4	.48
Korea	KOR	3	81	4.80	6.27	2,037	51.9	23.5	6.0	166.3	.71
Malaysia	MLY	1	243	4.80	6.27	2,261	52.8	25.4	12.7	137.7	.50
Philippines	PHL	3	136	4.80	6.27	1,998	44.6	24.0	8.9	124.2	.57
Taiwan	TAI	1	142	4.80	6.27	2,349	58.5	26.2	16.0	160.5	.43
Southeast Asia	SEA	(5)	(84)	(4.80)	(6.27)	(2,141)	(45.5)	(19.7)	(6.1)	(149.8)	(.53)
Burma	PRM	2	63	4.80	6.27	2,166	46.2	19.0	4.1	154.3	1.31
Thailand	THA	3	98	4.80	6.27	2,124	45.0	20.2	7.5	146.8	.07
World total		307	472.9	5.06	6.89	2,404	66.0	26.0	24.9	129.2	3.55

1/ A single year or span of years centered on 1962 is used where possible, otherwise, the nearest date for which data was available. The time base is defined either in (12) or in app. table 11.

Note: Grain component of U.S. figures does not include grain sorghum.

Source for columns (left to right): Population districts -- calculated from (12, vol. 2, table I.1); Income per capita -- gross domestic products, 1962 dollar equivalent (12, vol. 2, table I.3); Meat to wheat -- (12, vol. 2, table I.14); Meat to grain -- (12, vol. 2, table I.14); Calories -- (12, vol. 2, table A); Total protein -- (12, vol. 2, table A); Animal protein -- calculated from (12, vol. 2, table A); Meat consumption -- beef, veal, pork, poultry, mutton, lamb, goat, game, and other, calculated from (12, vol. 2, table A); Grain consumption -- calculated from (12, vol. 2, table A); Grain-meat ratio -- app. table 1; and Feed consumption share -- calculated from app. table 2.

Per capita meat consumption was highest for the year in Oceania (110.0 kilograms), followed by Argentina and Uruguay (99.6), the United States (89.5), France (85.9), and Canada (76.6). Except for Argentina and Uruguay, whose stages of development are debatable, the countries just mentioned are treated as developed countries. At the lower end of the scale of developed countries, in Greece, Portugal, and Spain, per capita meat consumption averaged 25.5, 19.7, and 20.9 kilograms, respectively. Japanese meat consumption averaged only 6.4 kilograms per person.

In central plan countries, annual per capita meat consumption ranged from 14.1 kilograms in Communist Asia to 40.8 kilograms in Eastern Europe. East Germany topped the scale of individual countries with 55.3 kilograms, a figure not altogether different from West Germany's 60.5 kilograms.

Among the less developed countries, meat consumption ranged from 2.2 kilograms per person per year in South Asia to 40.5 kilograms in East South America. Among individual countries, Argentina (99.6 kilograms), Colombia (35.9 kilograms), and Chile (33.3 kilograms) led, while at the lower end of the scale were India (1.4 kilograms), Ceylon (2.1 kilograms), and Pakistan (3.5 kilograms).

While the philosophical question of the relationship of meat consumption to economic development has not been directly analyzed, the hypothesis that such a relationship exists is supported by the results of a cross-sectional analysis of per capita meat consumption, country by country, throughout the world. The study is in the form of a multiple regression computed through use of data from that accumulated by FAO in connection with its projections for 1975 and 1985. Per capita meat consumption was related to per capita income and to the price of meat expressed in relation to the price of coarse grain. Statistically significant regression coefficients were obtained, together with a coefficient of multiple determination of .83, indicating that, statistically, over 80 per cent of the variation in per capita meat consumption observed around the world is associated with variations in price and income. A price elasticity of -.6 was obtained at the means. Income elasticity varies with income, but at the mean per capita income, this elasticity was found to be about .65.

The results seem rather convincing in support of the hypothesis that a worldwide consumption function for meat exists. The regression equation is given below:

Equation 1.--

$$\begin{array}{l} \text{MPC} = -0.0226 \text{ PMW} + 0.0317 \text{ YPC} - 0.1145 \text{ INV} + 33.6709 \\ \quad (0.0085) \quad (0.0018) \quad (0.0170) \end{array} \quad \begin{array}{l} R^2 = 0.8345 \\ s^2 = 10.9032 \end{array}$$

where --

MPC is per capita consumption of meat, by country, for the world in kilograms per annum;

PMW is the average price of a kilogram of meat, by country, deflated by the price of a kilogram of wheat;

YPC is the per capita income, by country, expressed in U.S. dollar equivalent per annum; and

INV is the inverse of YPC, defined above, multiplied by 10,000.

Results of the computation are shown in figure 11.

Several alternative formulas were also fitted to the same set of data. While the foregoing equation lends itself well to projection, the others possess strong analytical force:

Equation 2.--

$$\begin{aligned} \text{MPC} = & -0.02103 \text{ PMG} + 0.03758 \text{ YPC} + 21.33487 \\ & (0.00910) \quad (0.00173) \end{aligned} \quad \begin{aligned} R^2 = & 0.8096 \\ S^2 = & 11.5613 \end{aligned}$$

Equation 3.--

$$\begin{aligned} \text{MPC} = & -0.00939 \text{ PMG} + 0.01117 \text{ YPC} - 0.01846 \text{ INV} + 0.95356 \text{ PRT} \\ & (0.00671) \quad (0.00206) \quad (0.01499) \quad (0.06866) \\ & +2.37941 \end{aligned} \quad \begin{aligned} R^2 = & 0.8994 \\ S^2 = & 8.4306 \end{aligned}$$

Equation 4.--

$$\begin{aligned} \text{MPC} = & -38.61012 \text{ PMG} + 2.15288 (\text{PMG})^2 + 0.58676 (\text{PMW})^2 + 33.50444 \text{ YPC} \\ & (6.79179) \quad (0.43196) \quad (0.06702) \quad (1.80794) \\ & +152.56609 \end{aligned}$$

INV removed $\begin{aligned} R^2 = & 0.8505 \\ S^2 = & 10.2775 \end{aligned}$

where the variables are defined in Equation 1 and in addition --

PMG is the average price of a kilogram of meat, by country, deflated by the price of a kilogram of coarse grain; and

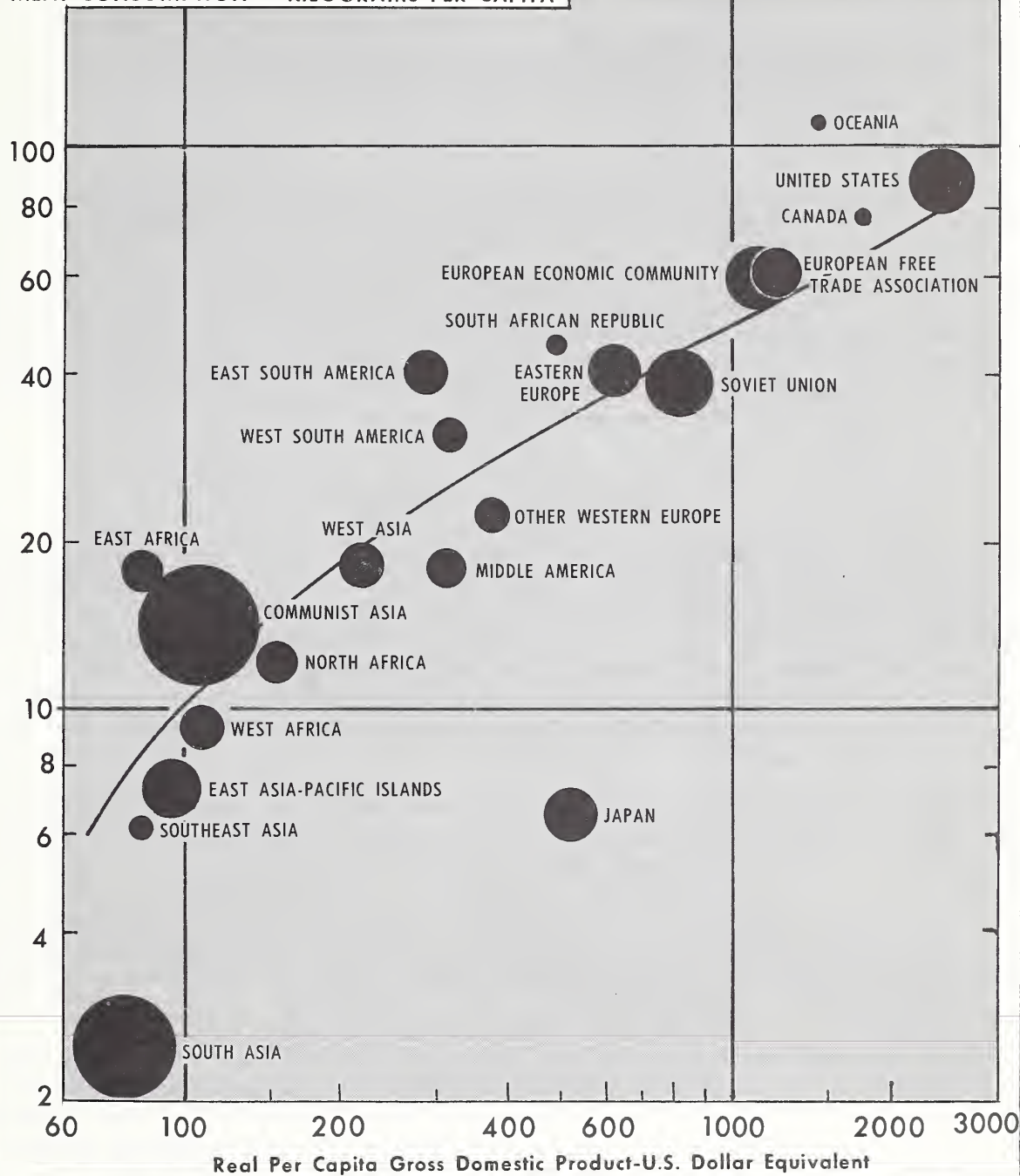
PRT is an index expressing the percent that animal protein represents of total protein in the human diet, by country.

A number of features of Equation 1 merit special attention. In the income range of \$80-\$150 a year per capita, meat consumption increases in proportion to income. Below this range, data are poor and results cannot be accepted as final, but the evidence is strong that meat consumption tends to grow in more than direct proportion to income. This feature probably reflects the strong drive, at low income levels, to improve on the quality of diets. For incomes higher than \$200, meat consumption evidently continues to rise strongly but less than proportionally to income, and this proportion tends to fall as income

WORLD: MEAT CONSUMPTION

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MEAT CONSUMPTION -- KILOGRAMS PER CAPITA



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Figure 11

risers. The particular mathematical function fitted to the data has determined that this proportion is at a minimum at an income of about \$350, and that it rises again to full proportionality at income levels beyond the range of data analyzed. These results in the upper income range are hard to relate to demand and consumption theory and seem to depend too much on the mathematical form of the function that was fitted.

These conclusions are shown in table 47 where column (1) shows income elasticities computed for each region at its average per capita income. Column (2) shows adjusted income elasticities based on the computations underlying column (1) and adjusted by judgment based on the behavior of time-series data for the developed countries and selected other countries and on the degree by which the cross-sectional plotting points of Equation 1 deviated from the observed values. The uniform regional elasticities were calculated from Equation 4.

Equation 4 was computed with a stepwise computer regression program. Per capita meat consumption is expressed in quadratic forms in the planes of the meat-grain price ratios and in linear form in per capita income. Theoretical allowance was made for a direct-inverse income relationship, but the inverse income term was not retained in the final computed form.

Grain Consumption for Food

Human per capita consumption of cereal grains averaged 129.2 kilograms throughout the world during 1962. Cereal grains were comprehensively defined to include wheat, rice, and coarse grains. Well below this figure, per capita cereal grain consumption in the developed countries stood at 98.0 kilograms for the year. Well above this figure, in the central plan countries, it was 157.0 kilograms. Below their average, in turn, but above the world average, each person in the developing countries consumed an annual average of 133.8 kilograms of cereal grain.

In the developed countries, grain consumption was lowest in the United States (66.0 kilograms) and Canada (66.3 kilograms) and highest in the Republic of South Africa (166.5 kilograms) and Japan (149.2 kilograms).

Among central plan regions, it ranged from 152.9 kilograms in Communist Asia to 171.4 kilograms in the Soviet Union. The highest per capita grain consumption in the world is recorded for Bulgaria (202.4 kilograms) and Romania (194.3 kilograms).

In an intermediate range are the less developed regions, extending from 74.6 kilograms in western South America to 150.6 kilograms in western Asia. Individual countries in this group range from Turkey (169.4 kilograms) down to Chile, whose 64.6 kilograms are the world's lowest per capita annual grain consumption.

On the hypothesis that human grain consumption, like meat consumption, is systematically related to economic development, per capita annual cereal grain consumption was related by multiple regression to per capita income and other

Table 47.--World: Income elasticities of demand for meat consumption,
by region, 1962

Region or country	Elasticity		
	Computed (1) <u>1/</u>	Adjusted (2) <u>2/</u>	Uniform (3) <u>3/</u>
		-- <u>Rate</u> --	
Developed countries .....	.65	.60	.65
United States .....	.70	.55	.65
Canada .....	.70	.60	.65
European Community .....	.70	.70	.65
EFTA* .....	.70	.70	.65
Other Western Europe .....	.55	.65	.65
Japan .....	.64	.70	.65
South African Republic ...	.63	.63	.65
Oceania	0	0	.65
Central plan countries .....	.57	.57	.65
Soviet Union .....	.63	.63	.65
Eastern Europe .....	.63	.63	.65
Communist Asia	1.00	1.00	.65
Less developed countries ...	.90	.85	.65
Middle America .....	.56	.56	.65
East South America** .....	.58	.40	.65
West South America .....	.56	.56	.65
North Africa .....	.82	.82	.65
West Africa	1.10	1.00	.65
East Africa	1.50	1.00	.65
West Asia .....	.65	.65	.65
South Asia	1.50	1.00	.65
East Asia-Pacific Islands :	1.50	1.00	.65
Southeast Asia	1.50	1.00	.65
World total .....	.55	.65	.65
* Of which: U.K. ....	.63	.63	.65
** Of which: Argentina ...	0	0	.65

1/ Column (1) computed from Equation 1 in text.

2/ Column (2) based on the computation from Equation 1 in text and adjusted by judgment from the observation of time series and by the degree by which the cross-sectional plotting points of Equation 1 deviated from the calculated values.

3/ Column (3) computed from Equation 4 in text.

variables in a country-by-country cross-sectional analysis of the world. Although the relationships obtained are not so tight and free from variation as in the meat consumption function, the results are convincing. The computed regression equations are presented below:

Equation 5.--

$$\begin{aligned} 1g \text{ CPC} = & -0.4305 \text{ } 1g \text{ PWM} - 0.4436 \text{ } 1g \text{ YPC} - 0.2579 \text{ INV} + 4.3350 \\ & (0.0525) \quad (0.0264) \quad (0.0258) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.5601 \\ S^2 &= 0.0830 \end{aligned}$$

Equation 6.--

$$\begin{aligned} 1g \text{ CPC} = & -0.2793 \text{ } 1g \text{ PWM} - 0.0782 \text{ } 1g \text{ YPC} - 0.1310 \text{ INV} - 0.0066 \text{ PRT} + 3.2084 \\ & (0.0485) \quad (0.0443) \quad (0.0261) \quad (0.0007) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.6635 \\ S^2 &= 0.0726 \end{aligned}$$

Equation 7.--

$$\begin{aligned} 1g \text{ CPC} = & -0.6765 \text{ } 1g \text{ PWM} + 0.5845 \text{ } 1g \text{ PGM} - 0.1125 \text{ } 1g \text{ PRC} - 0.0145 \text{ } 1g \text{ YPC} \\ & (0.0508) \quad (0.0898) \quad (0.0082) \quad (0.0389) \\ & -0.0975 \text{ INV} \quad - 0.0066 \text{ PRT} \quad + 2.8800 \\ & (0.0238) \quad (0.0005) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.7962 \\ S^2 &= 0.0565 \end{aligned}$$

where --

CPC is per capita human consumption of all cereal grain in kilograms, by country in 1962;

PWM is the price of a kilogram of wheat, deflated by the price of a kilogram of meat, by country;

PGM is the price of a kilogram of coarse grain, deflated by the price of a kilogram of meat, by country;

PRC is the price of a kilogram of root crops, deflated by the price of a kilogram of wheat, by country;

YPC is per capita income by country, expressed in U.S. dollar equivalent per annum in 1962;

INV is the inverse of YPC, defined above, multiplied by 10,000;

PRT is an index expressing the percent that animal protein represents of total protein in the human diet, by country; and

lg indicates a variable in logarithms to the base 10.

Equation 5 lends itself most readily to projection work, though the others present insight into the complexity of the variables that govern grain consumption. Most of the computed regression coefficients are significant, and the variation explained by the equations ranges from 56 percent for Equation 5 to 80 percent for Equation 7.

The computed function corresponding to the first of the above equations is presented graphically in figure 12. Regional averages are shown in relation to the function, though the computation was in terms of individual countries weighted by population districts. Attention is called to (1) the flatness of the curve, (2) the maximum that occurs in the income range of \$100-\$200 a year, (3) the unconvincing trend over the income range that separates Communist Asia and the Soviet Union, and (4) the declining trend among high-income regions.

Income elasticities of per capita grain consumption appropriate to the average per capita income of the regions of the world have been calculated with Equation 5 and are presented as column (1) of table 48. These coefficients point up the comments on the shape of the function. Column (2) presents elasticity coefficients adjusted in the developed country range by the algebraic addition of $-.10$ to yield results more in line with time-series analysis.

The Grain-Meat Ratio

An average of 3.55 kilograms of feed grain was used throughout the world in producing each kilogram of meat in 1962 (fig. 9). Grain of all kinds, including wheat, rice, and coarse grains, totalling 266.7 million metric tons, is estimated to have been fed to livestock in producing 75 million metric tons of meat. The definition of meat is comprehensive, including pork, beef, veal, mutton, poultry, as well as buffalo, camel, rabbit, and so on, but not fish. Other livestock products, such as 346.9 million tons of milk and 13.9 million tons of eggs, are disregarded in computing the grain-meat ratio.

In the developed countries as a group, according to this data, 4.59 kilograms of grain are associated with each kilogram of meat production, in contrast with only 1.3 kilograms of grain among the less developed countries. Among the central plan countries, an average of 3.6 kilograms of feed grain is consumed by livestock for each kilogram of meat produced.

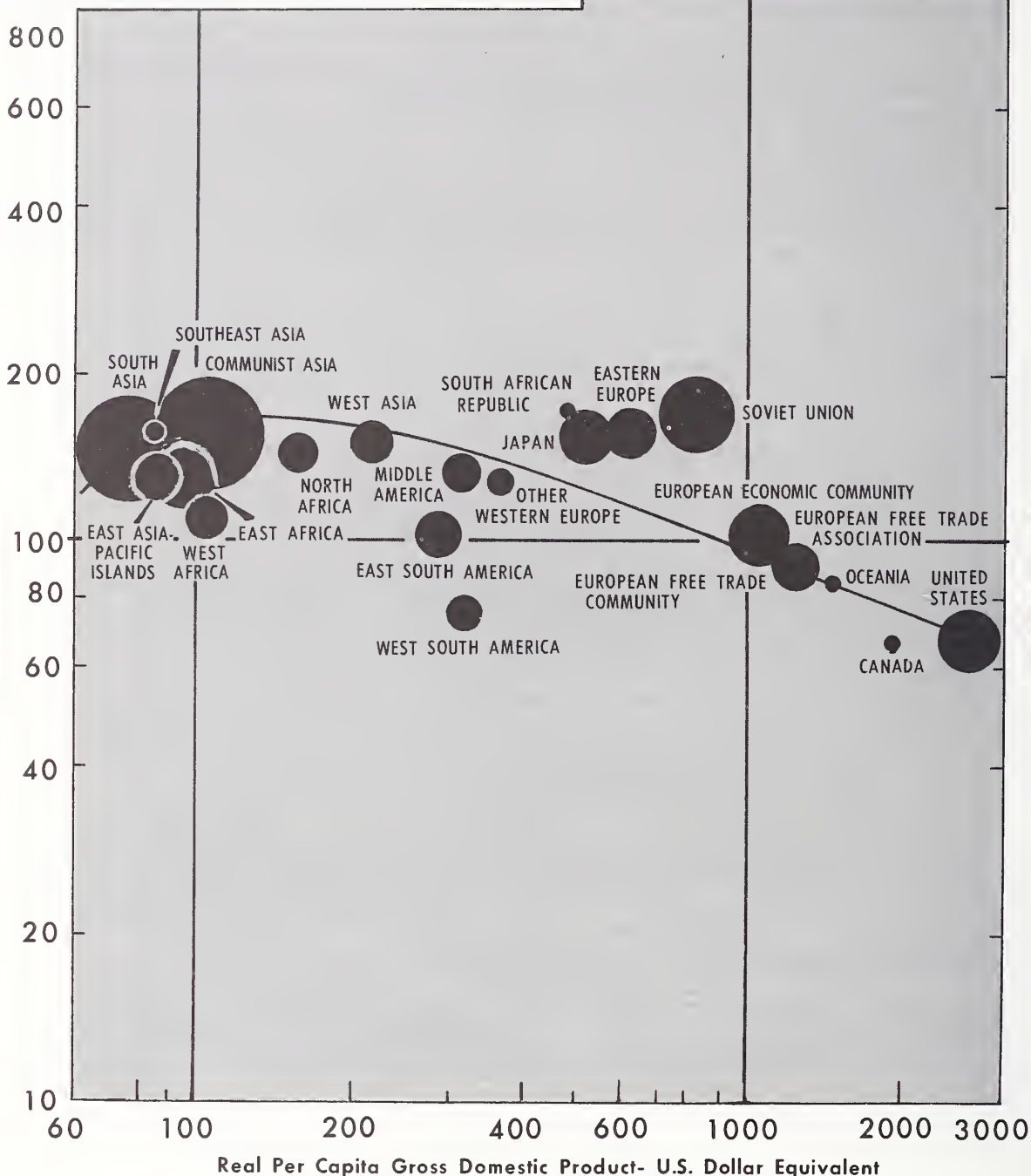
Feed grain consumption reached 180.9 million tons in the developed countries, 61.8 million tons in the central plan countries, and 24 million tons among the less developed countries. Meat production, meanwhile, stood at 39.4 million, 17.2 million, and 18.5 million tons in the developed, central plan, and less developed countries, respectively.

These figures show clearly that the developed countries, with over half of world meat production -- 52.5 percent -- account for over two-thirds of world feed grain consumption -- 67.8 percent -- and constitute, by far, the world's largest market for feed grains. The central plan countries account for slightly less than one-quarter of both world meat production -- 22.9 percent -- and

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Figure 12

Table 48.--World: Income elasticities of demand for per capita human consumption of grain, by region, 1962

Region or country	Elasticity	
	Computed (1) <u>1/</u>	Adjusted (2) <u>2/</u>
	-- <u>Rate</u> --	
Developed countries	-.17	-.27
United States	-.18	-.28
Canada	-.18	-.28
European Community	-.17	-.27
EFTA*	-.17	-.27
Other Western Europe	-.12	-.22
Japan	-.14	-.24
South African Republic	-.14	-.24
Oceania	-.17	-.27
Central plan countries	-.11	-.11
Soviet Union	-.16	-.16
Eastern Europe	-.15	-.15
Communist Asia .....	.07	.07
Less developed countries	0	0
Middle America	-.10	-.10
East South America**	-.10	-.10
West South America	-.11	-.11
North Africa	0	0
West Africa	0	0
East Africa .....	.10	.10
West Asia	-.07	-.07
South Asia .....	.15	.15
East Asia-Pacific Islands .....	.07	.07
Southeast Asia .....	.12	.12
World total	-.14	-.14
* Of which: U.K.	-.17	-.27
** Of which: Argentina	-.14	-.14

1/ Column (1) computed from Equation 5 in text.

2/ For column (2), the adjustment consists of augmenting the elasticities shown in column (1) by -.10 uniformly in the group of developed countries.

world feed grain consumption -- 23.2 percent. However, the less developed countries, with 44 percent of world population and one-quarter of world meat production -- 24.6 percent -- consume only 9 percent of the world's feed grain.

It might seem that computing the grain consumed in the production of individual types of livestock products would provide a series of figures that, taken together, would afford greater insight into the development process; that is, instead of only a grain-meat ratio, the following set of ratios could be used: grain-poultry, grain-pork, grain-beef, grain-milk, grain-eggs, and other minor ratios.

Information to enable such calculations is much to be desired to evaluate the status and progress of livestock husbandry in individual countries and regions, to help explain factors affecting feed grain consumption, and to project future demand for feed grain. Very regrettably, however, this information is not available. Not even all the developed countries possess reliable current estimates of grain consumption, by kind of livestock or according to type of livestock product. The less developed countries are far from furnishing such information. The figures presented here are crude and sometimes highly conjectural. Errors in some estimates are serious. It is probable that grain consumption by livestock -- and even livestock production in the less developed countries -- is underestimated. This should be corrected in the course of time. But a pattern is evident. It will appear with greater clarity as the basic knowledge of the world grain-livestock economy is improved.

Among the regions containing developed countries, Canada and the United States lead with a grain-meat ratio of 6.94, while Japan's ratio measures a close third, with 5.49. Individual countries, however, have higher ratios: Sweden, 6.28, Spain, 6.13, and Italy, 5.63. The lowest scores in this group of countries are registered by Oceania (0.55), Republic of South Africa (1.35), and Portugal (1.84).

Among the central plan countries, the grain-meat ratio stood at 3.35 in the Soviet Union, 1.58 in Communist Asia, and reached 6.58 in Eastern Europe, with Bulgaria and Yugoslavia presenting the highest ratios of any countries of the world, 9.75 and 8.64, respectively. The high ratio obtained in Eastern Europe reflects the long tradition of this region as an intensive grain producer and possibly, a practice of grain feeding for an absolute maximum output of meat and other livestock products instead of a conditional maximum constrained by consideration of input and product prices and profitability.

West Asia and West Africa present the extremes obtained by the regions containing less developed countries, with ratios of 4.35 and 0.14, respectively; other regions occupy intermediate positions. Among individual countries, Turkey at 8.35 is a leader in this group, with a suggestion of husbandry practices that reflect an affinity with those of Eastern Europe. India showed 1.26, Indonesia, 0.48, and Pakistan, 0.21. Sudan and Senegal both measured 0.03.

In a cross-sectional multiple-regression calculation for the world weighted, as described earlier, by population districts, the grain-meat ratio is found to be related to per capita income around the world as follows:

Equation 8.--

$$\text{RGM} = 0.00033 \text{ YPC} - 0.01890 \text{ INV} + 1.32839 \text{ DEV} + 0.55058 \text{ PLN} + 3.17457$$

(0.00018) (0.00222) (0.31410) (0.18046)

$$R^2 = 0.59499$$

$$S^2 = 1.27906$$

where --

RGM is grain-meat ratio, understood as kilograms of grain actually accounted for in producing 1 kilogram of meat in 1962;

YPC is gross domestic product per capita, in U.S. dollar equivalent in 1962;

INV is inverse of YPC multiplied by 10,000;

PLN is a variable that is 1 if the population district in question belongs to a central plan country, otherwise, 0;

DEV is a variable that is 1 if the population district in question belongs to a developed country, otherwise, 0.

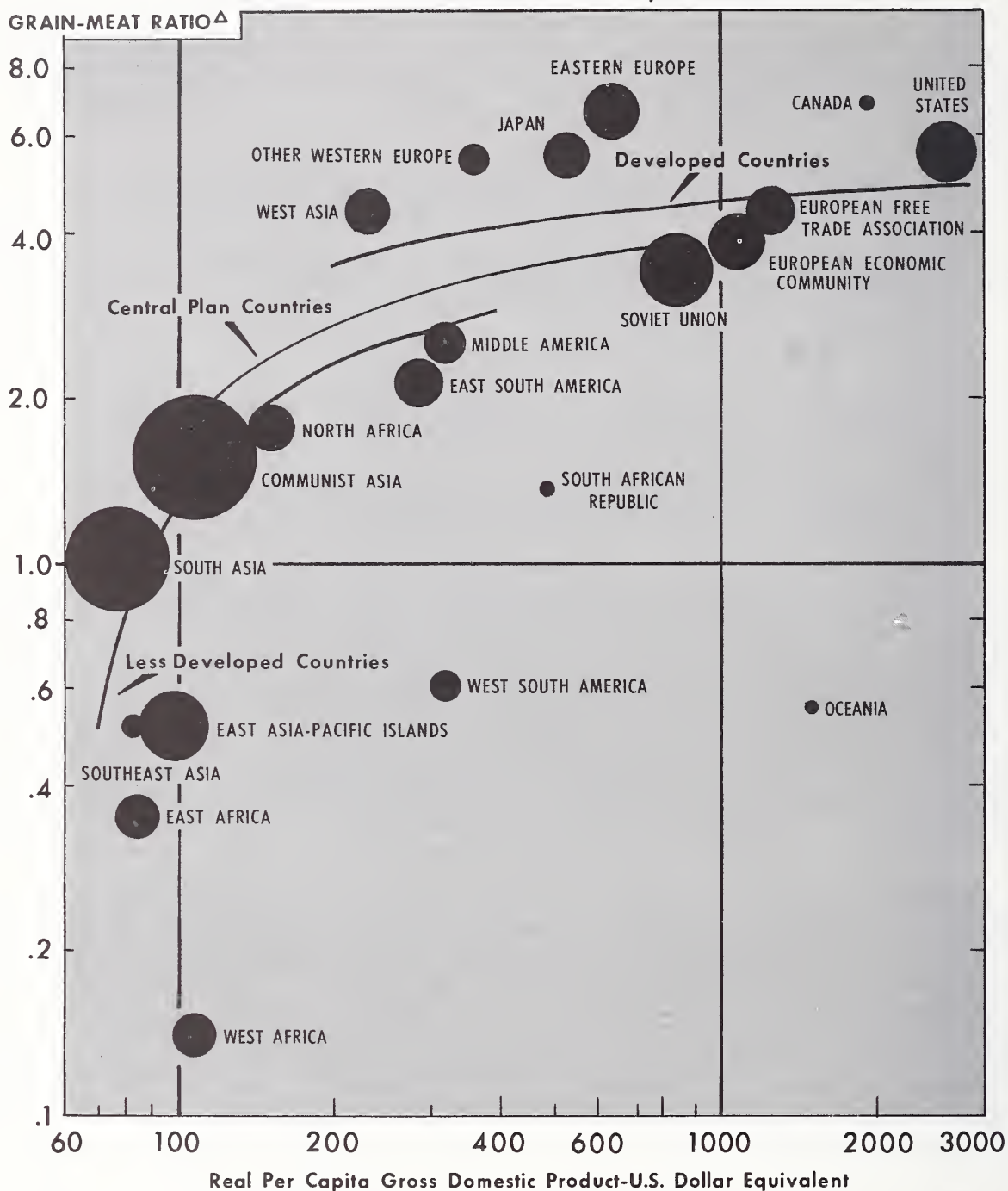
The results of this computation are shown graphically in figure 13. Although the mathematical fit was performed in terms of the population districts listed in table 46, the plottings show regional groupings for easier comprehension of the fitted relationship. Although the relationship of the grain-meat ratio to income and population is shown on a logarithmic scale, solely for pictorial convenience in handling the extended income scale, the computations were made in the arithmetic form of the variables. The fitted function is depicted in three levels, which correspond progressively to an ascending sequence of development. The lower line applies to the less developed, the middle line to the central plan, and the upper line to the developed countries and regions.

Except for the coefficient on direct per capita income, statistically significant regression coefficients were obtained. However, the coefficients on direct and inverse per capita income are used as a pair, and the overall statistical significance of per capita income is deemed quite satisfactory, since the coefficient in question serves to establish an upward-sloping asymptote toward which the function rises with increasing income. The coefficient of multiple determination is .595, which indicates that just under 60 percent of the variation in the grain-meat ratio is associated statistically with per capita income and with two 0-1 variables that express level of economic development.

Two features of the fitted function bear underscoring. First, in the income range of about \$100 a year, the change in the grain-meat ratio is proportional to the change in average per capita income. Below this income level, and it must be remembered that data are poor in this range, the evidence indicates that the grain-meat ratio tends to rise rapidly with a rise in average income. The change will be more than proportional to income change.

WORLD: GRAIN-MEAT RATIO

Related to Income and Population*



^Δ KILOGRAMS OF GRAIN PER KILOGRAM OF MEAT.

* THE AREAS OF CIRCLES ARE PROPORTIONAL TO POPULATION.

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Figure 13

It is as though there was involved in the development processes in their early -- or low-income -- stage a quantum leap in regard to the appropriate role of domestic animals in relation to human society. The main sequence of economic development, in terms of animal feeding, passes well above -- and seemingly out of reach -- of an important group of very low-income countries.

Second, the grain-meat ratio seems to be rising toward a limiting ceiling whose equation may be calculated from the fitted function as:

$$\text{Equation 9.--} \quad \text{RGM} = 0.00033 \text{ YPC} + 4.60296$$

The ceiling rises slightly with rising income. Some of the Eastern European countries have exceeded this limiting ceiling and seem to be allocating their resources in livestock on different patterns than Western Europe.

The grain-meat ratio was also regressed, along with the independent variables discussed above, on a set of variables that represent the regional structure of livestock production. The importance of the individual meats was calculated by region and various joint-product ratios that involved other livestock products.

The computed relationships are:

$$\text{Equation 10.--}$$

$$\begin{aligned} \text{RGM} = & .00007 \text{ YPC} - .02708 \text{ INV} - .01202 \text{ BOV} + .06898 \text{ PTY} + .01172 \text{ XMB} \\ & (.00015) \quad (.00211) \quad (.00496) \quad (0.1649) \quad (.00226) \\ & + .92010 \text{ DEV} + .75232 \text{ PLN} + 3.34666 \\ & (.28311) \quad (.20163) \end{aligned}$$

$$\begin{aligned} R^2 &= .72205 \\ S^2 &= 1.01500 \end{aligned}$$

$$\text{Equation 11.--}$$

$$\begin{aligned} \text{RGM} = & .00028 \text{ YPC} - .03082 \text{ INV} - .02457 \text{ BOV} + .05298 \text{ PTY} + .00925 \text{ XMB} \\ & (.00014) \quad (.00191) \quad (.00387) \quad (.01539) \quad (.00221) \\ & + 4.62391 \end{aligned}$$

$$\begin{aligned} R^2 &= .70929 \\ S^2 &= 1.02801 \end{aligned}$$

$$\text{Equation 12.--}$$

$$\begin{aligned} 1g \text{ RGM} = & .55432 1g \text{ MPC} - .00423 \text{ BOV} + .00837 \text{ PTY} + .00828 \text{ XMB} \\ & (.05546) \quad (.00122) \quad (.00391) \quad (.00071) \\ & + .35899 \text{ DEV} + .31981 \text{ PLN} - .70619 \\ & (.06289) \quad (.04996) \end{aligned}$$

$$\begin{aligned} R^2 &= .63962 \\ S^2 &= .25498 \end{aligned}$$

where RGM, YPC, INV, DEV, and PLN are defined in Equation 8 and in addition:

BOV is the percentage of meat from bovine animals in total meat production, by country, in 1962;

PTY is the percentage of poultry meat in total meat production, by country, in 1962;

XMB is the joint-product ratio of milk from all animal sources to meat from bovine animals, by country, in 1962;

MPC is per capita consumption of meat in kilograms per annum, by country, for the world, in 1962; and

lg indicates that a variable is expressed in logarithms to the base 10.

These equations reveal clearly that the intensity of grain feeding of livestock is related in a positive way to both per capita income and level of development. Such grain feeding is significantly related, but in a negative way, to the proportion of bovine meat in total meat output. The intensity varies positively with the proportion of poultry meat in total meat production. And, the degree of intensity is related positively to the output ratio of milk to bovine meat; that is, the more milk is produced in relation to beef and veal, the higher the intensity with which grain tends to be fed. The variables in Equations 10 and 11 are all statistically significant. Other indicators of the structure of livestock production also tried in computation include pork alone as a percentage of total meat output, pork plus poultry, and the output ratio of eggs to poultry meat. Results were ambiguous. These percentage components, as they stand in the base period, are shown in table 49.

It is noteworthy that the use of dummy variables in Equation 10 for indicating levels of development is the only difference between Equations 10 and 11, and that this procedure raises the coefficient of determination by only 1 percent, from 70.9 to 72.2 percent, while lowering the strength of regression coefficients associated with income, inverse of income, and the bovine proportion. Both equations appear to be about equally useful.

Equation 12 substitutes per capita meat consumption for per capita income as a determinant of the grain-meat ratio. Again, all the terms are significant, and the remaining variables carry the same signs as in Equations 10 and 11. Equation 12 determines 64 percent of the variation in the grain-meat ratio.

The relationship between the grain-meat ratio and the various grain utilization rates for particular livestock products may be illustrated in the European Economic Community. From the FAO and OECD data analyzed here, the number 3.79 has been calculated for the grain-meat ratio in 1962. By using the more elaborate data presented by the EEC, a more sophisticated calculation can be made that gives 3.36 as the grain-meat ratio and places it in the context of a family of related grain utilization rates that relate grain input to specific livestock products (table 50). The estimated rates range from 0 for veal and .25 for minor meat to 3.41 for pork, and when livestock products other than meat are included, a rate of .11 for milk and 3.11 for eggs. The

Table 49.--World: Percentage of bovine meat and poultry meat in total meat production and the ratio of milk to total meat production, by region, 1962

Region or country	Bovine meat	Poultry meat	Milk-to-meat production
	Percent		Ratio
Developed countries	40	14	11.8
United States	43	18	7.3
Canada	46	17	12.0
European Community	37	11	11.2
EFTA*	34	10	18.0
Other Western Europe	37	9	13.9
Japan	22	15	14.2
South African Republic	66	4	5.6
Oceania		21	11.9
Central plan countries	32	9	15.3
Soviet Union	43	10	15.1
Eastern Europe	25	10	25.6
Communist Asia	21	6	1.4
Less developed countries			
Middle America	56	7	7.1
East South America**	77	3	2.2
West South America	67	4	3.9
North Africa	42	14	11.6
West Africa	44	9	3.0
East Africa	62	6	3.7
West Asia	30	6	24.3
South Asia	42	11	55.2
East Asia-Pacific Islands	13	13	.3
Southeast Asia	46	12	.7
World total	42	11	10.9
* Of which: U.K.	38	14	14.8
** Of which: Argentina	87	1	1.6

Source: App. table 5.

Table 50.--EEC: Livestock production, grain utilization rates, and grain used as feed, 1962

Products	Livestock production	Feeding ratios <u>1/</u>	Grain fed to livestock
	<u>Mil. m.t.</u>	<u>Rate</u>	<u>Mil. m.t.</u>
Total meat (with grain inputs allocated)	10.377	(2.077)	21.549
Major meats	9.800	(2.184)	21.404
Beef and veal	4.210	(.743)	3.127
Beef	3.467	.902	3.127
Veal .....	.743	0	0
Pork	4.613	3.410	15.730
Poultry .....	.977	2.607	2.547
Minor meats .....	.577	.251	.145
Other products:			
Milk	65.407	.111	7.260
Eggs	1.957	3.109	6.084
Total meat and livestock products	---	---	34.893
Total meat (with grain inputs unallocated)	10.377	(3.362)	34.893

1/ Parentheses identify computations made after allocating grain inputs.

Source: (24, p. 6).

data have not been located that would permit a similar calculation of rates for other world regions.

Table 47 provides a link from the broadly defined grain-meat ratio to the more narrowly defined utilization ratio in tables 51, 52, and 53, which were prepared by the OECD. These tables show specific commodity rates for countries of the OECD for 1962 and estimates for 1975 and 1985.

Feed Grain Consumption Share and Other Relationships

The Share of Feed Grain in Total Grain Consumption

Given the basic relationships developed in the foregoing sections, namely that

- Meat consumption per capita is strongly and positively correlated with income;

- Per capita grain consumption for food is strongly correlated with income, rising in very low-income ranges, steady at somewhat higher incomes, but falling with rising income through most of the ranges;

- The grain-meat output ratio is strongly and positively correlated with both per capita income and meat consumption;

It follows naturally that the proportion of total cereal grains devoted to livestock feeding in countries and regions of the world is also strongly and positively related to both per capita income and to per capita meat consumption.

Computed relationships testing this proposition are:

Equation 13.--

$$\text{SFC} = .02005 \text{ YPC} - .16880 \text{ INV} - .07714 \text{ PMG} + 4.90435 \text{ DEV} - 1.79828 \text{ PLN}$$

$$(.00157) \quad (.01526) \quad (.65951) \quad (1.99804) \quad (1.14430)$$

$$+ 22.07600$$

$$R^2 = .881$$

$$S^2 = 9.123$$

Equation 14.--

$$\lg \text{SFC} = .46337 \lg \text{YPC} - .00866 \text{ INV} - .00519 \text{ BOV} - .02120 \text{ PTY} - .00178 \text{ XMB}$$

$$(.09724) \quad (.00100) \quad (.00095) \quad (.00377) \quad (.00055)$$

$$+ .83350$$

$$R^2 = .860$$

$$S^2 = .256$$

Table 51.--Developed countries: Grain utilization rates in livestock production, 1962

(Kilograms of grain fed per kilogram of product obtained)					
Region or country	Meat			Milk	Eggs
	Pork	Poultry	Beef and veal		
<u>Rate</u>					
United States	8.3	4.4	3.0	0.3	3.9
Canada	7.8	2.4	5.0	0.3	4.9
Japan	6.3	1.8	1.2	0.3	2.7
OECD-Europe	3.8	3.7	1.7	0.08	3.5
European Community	3.4	4.0	1.2	0.05	4.0
Belgium-Luxembourg ...	3.07	3.00	1.6	0.06	2.40
Netherlands	2.98	3.50	1.8	0.07	2.84
France	3.65	4.05	1.2	0.04	3.20
Germany	2.74	4.50	0.9	0.05	3.75
Italy	7.3	4.2	1.6	0.1	5.7
Northwestern Europe	4.4	3.2	1.8	0.11	2.9
Austria	4.0	3.2	1.0	0.07	3.0
Denmark	4.2	3.1	2.1	0.1	3.9
Finland	4.9	-	3.6	0.1	3.2
Ireland	1.6	-	1.5	0.1	2.0
Norway	4.0	3.0	2.5	0.1	2.0
Sweden	5.0	4.1	2.6	0.1	3.7
Switzerland	2.7	3.8	0.8	-	3.5
United Kingdom	5.1	-	1.7	0.1	3.1
Other Western Europe ...	5.0	3.3	4.1	0.25	3.1
Greece	4.0	3.5	1.5	0.1	3.0
Portugal	3.0	0.8	1.4	0.2	0.9
Spain	4.5	3.5	3.0	0.2	3.5
Turkey	-	1.0	6.0	0.3	1.0
Yugoslavia	6.5	4.0	5.5	0.3	5.5
Oceania	2.1	2.1	0.3	0.02	2.7
Australia	2.5	1.8	0.5	0.1	2.7
New Zealand	1.5	2.9	0.1	0.1	2.7
OECD with Oceania	5.8	4.0	2.4	0.14	3.6

Source: (22, pp. 118-19).

Table 52.--Developed countries: Grain utilization rates in livestock production, 1975

(Kilograms of grain fed per kilogram of product obtained)

Region or country	Meat			Milk	Eggs
	Pork	Poultry	Beef and veal		
----- Rate -----					
United States.....	8.3	4.2	3.6	0.3	4.0
Canada	7.8	2.2	4.0	0.3	4.4
Japan	6.6	2.3	1.2	0.2	2.3
OECD-Europe	3.5	3.0	2.3	0.11	3.1
European Community	3.0	3.1	1.9	0.07	3.1
Belgium-Luxembourg ...	3.00	2.87	1.8	0.06	2.36
Netherlands	2.63	2.75	2.2	0.09	2.60
France	3.00	3.00	2.3	0.07	2.50
Germany	2.45	2.98	1.2	0.06	2.73
Italy	6.2	3.6	1.6	0.1	4.8
Northwestern Europe	4.0	2.8	2.5	0.15	2.8
Austria	3.8	3.0	1.5	0.1	3.2
Denmark	4.4	2.5	2.4	0.1	3.5
Finland	5.0	2.6	4.0	0.1	3.4
Ireland	1.5	2.2	1.3	0.1	1.8
Norway	5.0	4.0	3.0	0.25	3.0
Sweden	4.5	2.9	3.1	0.1	2.9
Switzerland	3.4	2.9	1.1	0.1	2.9
United Kingdom	4.6	2.2	2.1	0.2	2.7
Other Western Europe ...	4.4	2.1	4.3	0.30	3.1
Greece	4.0	3.5	2.0	0.1	3.0
Portugal	3.2	1.9	1.6	0.2	1.3
Spain	4.0	3.5	3.7	0.3	3.5
Turkey	-	1.5	6.2	0.4	1.5
Yugoslavia	5.5	4.5	5.0	0.3	5.0
Oceania	2.7	2.4	0.3	0.02	2.4
Australia	3.0	2.2	0.4	0.1	2.5
New Zealand	2.0	2.7	0.1	0.1	2.5
OECD with Oceania	5.4	3.5	2.9	0.16	3.4

Source: (22, pp. 118-19).

Table 53.--Developed countries: Grain utilization rates in livestock production, 1985

(Kilograms of grain fed per kilogram of product obtained)

Region or country	Meat			Milk	Eggs
	Pork	Poultry	Beef and Veal		
	Rate				
United States	8.3	4.2	4.0	0.3	4.0
Canada	7.8	2.1	4.0	0.3	3.7
Japan	6.3	2.4	1.7	0.1	2.4
OECD-Europe	3.3	2.7	2.5	0.13	2.9
European Community	2.9	2.9	2.1	0.08	3.0
Belgium-Luxembourg ...	2.68	2.52	2.0	0.07	2.12
Netherlands	2.63	2.52	2.5	0.10	2.51
France	2.85	2.52	2.6	0.09	2.50
Germany	2.43	2.87	1.4	0.07	2.59
Italy	5.5	3.2	1.6	0.1	4.2
Northwestern Europe	3.8	2.2	2.5	0.16	2.7
Austria	3.6	2.5	1.6	0.1	3.2
Denmark	4.4	2.2	2.4	0.1	3.1
Finland	5.0	2.8	4.0	0.1	3.8
Ireland	1.3	1.9	1.3	0.1	1.6
Norway	4.5	4.0	2.7	0.2	2.7
Sweden	4.0	2.4	3.1	0.1	2.6
Switzerland	3.5	2.4	1.4	0.1	2.5
United Kingdom	4.0	1.9	2.5	0.2	2.5
Other Western Europe ...	4.0	2.7	4.5	0.32	2.9
Greece	3.5	3.0	2.5	0.1	3.0
Portugal	3.3	2.0	1.7	0.2	1.6
Spain	3.5	3.0	4.2	0.4	3.0
Turkey	-	2.0	6.5	0.4	2.0
Yugoslavia	5.0	4.0	5.0	0.3	4.5
Oceania	3.0	2.4	0.3	0.02	2.2
Australia	3.4	2.2	0.4	0.1	2.3
New Zealand	2.5	2.6	0.1	0.1	2.3
OECD with Oceania	5.0	3.3	3.1	0.16	3.3

Source: (22, pp. 118-19).

Equation 15.--

$$\text{SFC} = .46940 \text{ MPC} - .15401 \text{ CPC} + 5.46208 \text{ RGM} + 15.23409$$

(.01449) (.01025) (.15254)

$$R^2 = .972$$

$$S^2 = 3.962$$

Equation 16.--

$$\text{SFC} = .32702 \text{ PMG} + .46128 \text{ MPC} - .15360 \text{ CPC} + 5.38516 \text{ RGM} + 13.31103$$

(.27204) (.01598) (.01025) (.16532)

$$R^2 = .972$$

$$S^2 = 3.959$$

Equation 17.--

$$\text{SFC} = .61360 \text{ MPC} + 4.88568 \text{ RGM} - 7.61300$$

(.01432) (.19474)

$$R^2 = .951$$

$$S^2 = 5.226$$

where YPC, INV, DEV, PLN, BOV, PTY, XMB, MPC, CPC, and RGM are defined earlier, and in addition:

SFC is the feed consumption share, defined as the percent of grain fed to livestock in relation to total cereal grain disappearance, by country, in 1962; and

lg indicates that a variable is expressed in logarithms to the base 10.

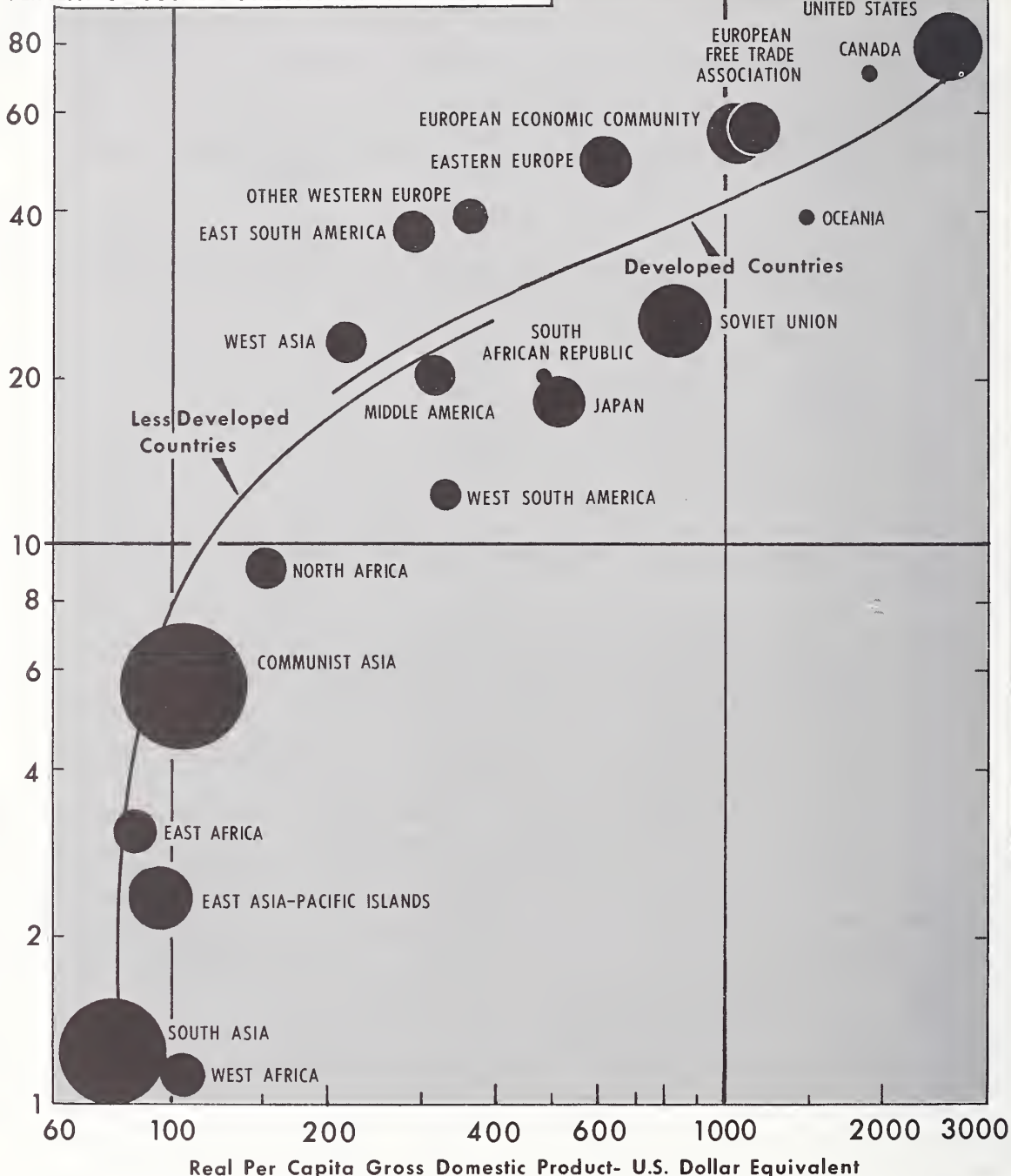
Equations 13 and 14 relate the feed grain share -- that is, the percentage of feed grain to total cereal grain disappearance -- to per capita income, and to the variables that represent levels of economic development and the structure of livestock production. Of the total variation observed in the feed grain share, 88 and 86 percent, respectively, are associated with the variables contained in the two equations (fig. 14). As is shown by the separate regression lines, the developed countries as a group allocate an appreciably larger share of grain to livestock than do other countries, even when allowance is made for per capita income in its direct and inverse forms. The same pattern holds for logarithmic forms of this relationship, although the equations are not shown. In contrast to this pattern, the central plan countries present evidence of allocating feed grain away from livestock, when allowance is made for per capita income. This observation must remain a hypothesis, however, for the relevant regression coefficient, while negative, is not statistically significant.

The three structural variables for livestock production (BOV, PTY, and XMB) all appear to be inversely and significantly related to the feed grain

WORLD: FEED GRAIN SHARE

*Related to Income and Population**

PERCENT OF TOTAL DOMESTIC GRAIN UTILIZATION



* THE AREAS OF CIRCLES ARE PROPORTIONAL TO POPULATION.

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Figure 14

share. Tentative hypotheses regarding the structure of the world livestock economy, compatible with the observed negative coefficients, are:

- A high component of beef or other bovine meat tends to be associated with a lessened share of grain for livestock;
- A high component of poultry meat in total meat output tends to be associated with a reduced level of meat production and hence, of feed grain use; on the other hand, not necessarily in the same region, a high component of poultry meat tends to be associated with technological efficiency in grain conversion; and
- A high level of total milk production relative to bovine meat tends to be associated with agricultural systems that obtain milk not only from cattle but also from sheep, goats, and other nonbovine animals that use relatively little grain; the high level also tends, in some instances, not necessarily in the same region, to be associated with regions of abundant green food and high technology in feed conversion and animal selection and breeding.

While tentative, these hypotheses are compatible with the coefficients incorporated into Equation 14 and cannot be rejected by reference to it.

When the feed grain share is regressed directly on per capita meat consumption, per capita grain consumption for food, and the grain-meat ratio, the percent of total variation explained by the fitted regression rises to about 97 percent. The feed grain share rises directly with meat consumption and the grain-meat ratio and inversely with grain consumption for food. The coefficients expressing these relationships in Equation 15 are all statistically significant (fig. 15).

Equation 16 expresses the concepts just discussed in connection with Equation 15 and, in addition, contains the idea that the share of grain allocated to feeding livestock tends to rise with higher meat prices relative to grain prices. The price coefficient is intuitively convincing although not statistically significant. The remaining terms are significant.

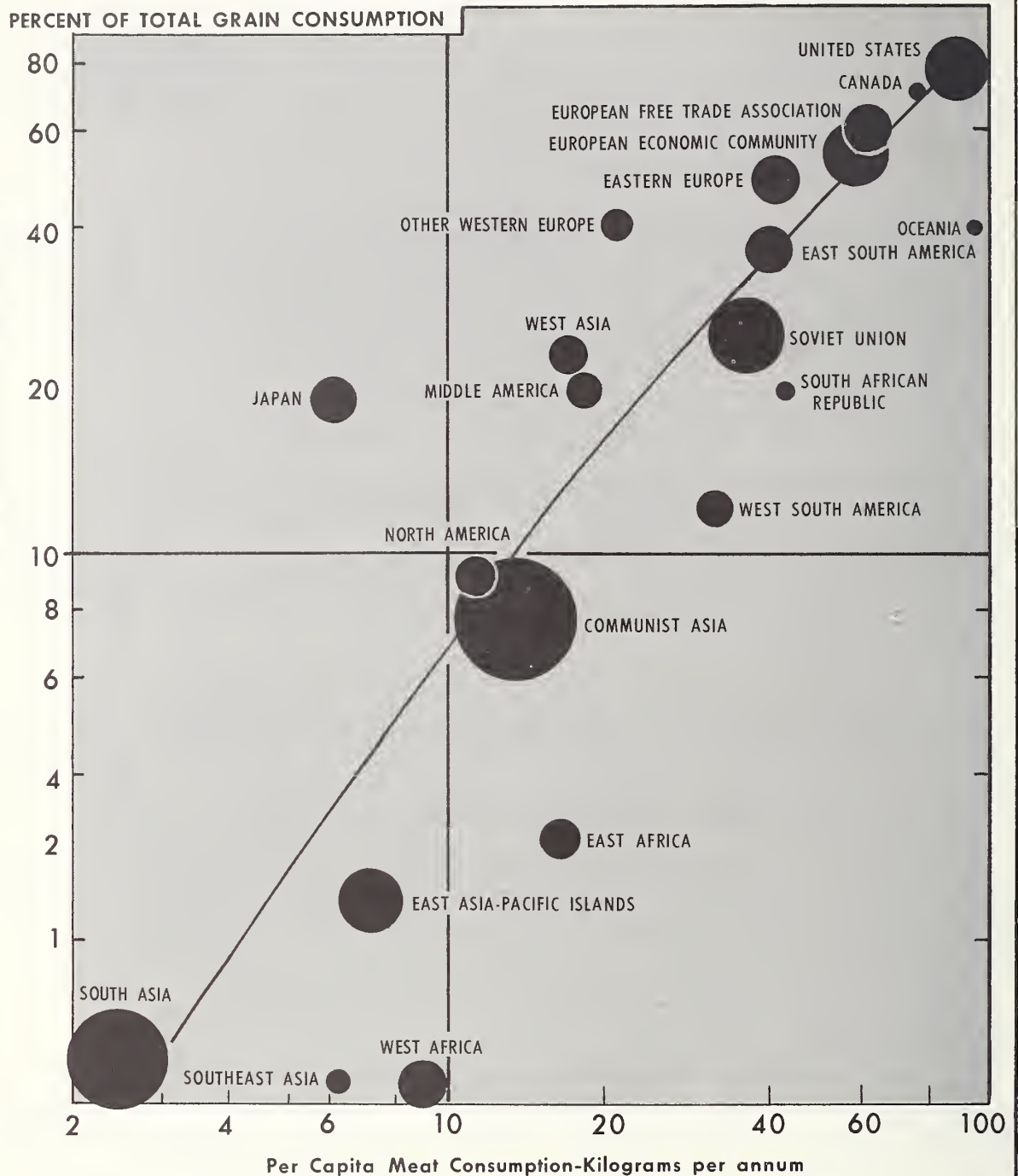
With terms that are numerically quite similar to those in the two preceding equations, Equation 17 shows the feed grain share as a function of meat consumption and the grain-meat ratio. This equation explains 95 percent of the total variation in the data.

Other Relationships

An effort was made to derive satisfactory formulas, in cross-sectional analysis, for determining the amount or share of coarse grain in grain fed to livestock; that is, in feed grain. Results were not very rewarding. The data, as analyzed in Equations 18 and 19, do not lend themselves to neat, easy generalizations about which grains, among the many used around the world, tend to be employed as animal feed. In a regression equation in which the share of coarse grain in feed grain was expressed as a function of (1) the feed grain share, (2) the structural variables of livestock production and (3) the

WORLD: FEED GRAIN SHARE

*Related to Meat Consumption and Population**



*THE AREAS OF CIRCLES ARE PROPORTIONAL TO POPULATION.

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Figure 15

variables related to stage of economic development, only 37 percent of the variation in the data could be explained. In Equation 18, however, marginal significance in explaining the share of coarse grain in feed grain can be attached to the proportion of bovine meat in total meat output. Higher significance can be attached to the output ratio of milk to bovine meat and to the fact that a country is in the central plan group.

Coefficients of determination of less than 20 percent were obtained for explaining grain and meat self-sufficiency. Nevertheless, Equations 20 and 21 are useful. The insignificance of the coefficients on income, their offsetting of direct and inverse terms on income, the static effect of the dummies that represent state of development (that is, they do not vary for a given region) -- these features of the two equations do not support the hypothesis of constant SSM and SSG over time. These features permit rejection of the counterhypothesis that income is significant.

Equation 18.--

$$\begin{aligned} \text{CGF} = & .03320 \text{ SFC} - .19094 \text{ PTY} + .12542 \text{ BOV} - .24642 \text{ XMB} + 4.89967 \text{ DEV} \\ & (.05499) \quad (.20094) \quad (.06000) \quad (.05852) \quad (3.44344) \\ & + 8.03268 \text{ PLN} + 86.60000 \\ & (2.37245) \end{aligned}$$

$$\begin{aligned} R^2 &= .372 \\ S^2 &= 12.980 \end{aligned}$$

Equation 19.--

$$\begin{aligned} \text{CGF} = & .13798 \text{ SFC} + .00651 \text{ SSM} - .07970 \text{ SSG} + 4.38991 \text{ DEV} + 13.50063 \text{ PLN} \\ & (.05886) \quad (.05443) \quad (.04814) \quad (3.59028) \quad (1.97949) \\ & + 87.03577 \end{aligned}$$

$$\begin{aligned} R^2 &= .168 \\ S^2 &= 14.935 \end{aligned}$$

Equation 20.--

$$\begin{aligned} \text{SSM} = & .00329 \text{ YPC} + .00499 \text{ INV} - 6.87331 \text{ DEV} - .44002 \text{ PLN} + 99.59901 \\ & (.00236) \quad (.03094) \quad (4.05744) \quad (2.31910) \end{aligned}$$

$$\begin{aligned} R^2 &= .002 \\ S^2 &= 16.530 \end{aligned}$$

Equation 21.--

$$\begin{aligned} \text{SSG} = & .01946 \text{ YPC} + .123813 \text{ INV} - 10.26905 \text{ DEV} + 4.47679 \text{ PLN} + 79.16036 \\ & (.00244) \quad (.03197) \quad (4.19313) \quad (2.39665) \end{aligned}$$

$$\begin{aligned} R^2 &= .175 \\ S^2 &= 17.083 \end{aligned}$$

where YPC, INV, SFC, BOV, PTY, XMB, DEV, and PLN are defined earlier, and in addition:

CGF is the share, in percentage terms, that coarse grain is of feed grain, by country, in 1962;

SSM is meat self-sufficiency, defined as the percentage that domestic supply is of total domestic disappearance, by country or region, in 1962; and

SSG is grain self-sufficiency, defined as the percentage that domestic supply is of total domestic disappearance, by country or region, in 1962.

The Combined Sequence

Five criteria have been established for classifying the world grain-livestock economy into arrays that reflect stages of development: Income, meat consumption, grain consumption for food, the grain-meat ratio, and the share of grain fed to livestock. The expected values in these arrays for given levels of per capita income are shown in table 54. They all start from low values for the bottom of the income scale and rise to high values for high levels of income, except for human consumption of grain, which rises to a maximum and thereafter falls. Income elasticities have been computed for these arrays as an attempt to show the proportionate change to be expected in a given array related to a postulated income change at different income levels. This practice may suggest that income is somehow an "independent" variable mathematically. This is not intended, though the notion may be a convenient assumption for simplifying some aspects of analysis. What is proposed is that these five arrays reflecting five aspects of economic development in the world grain-livestock economy are linked together in an interacting sequence. A balanced evolution along this sequence is what one expects, and extreme departures can be expected to prove transitory or to lead to processes of compensation; or else there are special circumstances of climate and natural and cultural history that have predetermined the situation depicted as of the years embracing 1962. Given its income situation, Japan, for example, is far below the expected level of meat consumption. In other regards, Japan is close to levels expected in the sequence. One can foresee that per capita meat consumption will increase substantially or that social pressures to bring about this result will develop. Similarly, the Soviet Union is seen to have substantially lower meat consumption per capita than its estimated income position would lead one to expect, as well as a much higher level of grain consumption for food, while supporting a very high grain-meat ratio. One suspects that a shift to a higher level of meat consumption is in the making, at the expense of a future decline in grain consumption for food.

The way in which the five strands of the development sequence are intertwined raises a number of theoretical and practical questions. Table 55 has been prepared to aid comprehension of the interrelationships, based on the formal implications of several of the fitted mathematical functions. At the extreme lower limit of per capita annual income -- less than \$60 -- no meat is consumed, no grain is allocated to livestock, and, of course, a grain-meat

Table 54.--Main sequence of the world grain-livestock economy

Income per capita <u>1/</u>	Human consumption per capita		Grain-meat ratio <u>4/</u>		Feed grain share <u>5/</u>	
	Meat <u>2/</u>	Cereal grain <u>3/</u>				
	Income	Income	Income	Income	Income	Income
	Quantity: elas- per year: ticity	Quantity: elas- per year: ticity	Quantity: elas- per year: ticity	kg. grain per kg. meat	Quantity: elas- per year: ticity	Relative: elas- portion: ticity
Dollar equiv.	Kg.	Rate	Kg.	----- Rate -----	Pct.	Rate
25	0	z	48.8	.84	0	z
50	0	z	117.8	.32	0	z
75	5.2	3.41	144.3	.15	.68	3.72
100	9.8	1.50	156.5	.07	1.31	1.44
125	12.9	1.02	164.3	.01	1.70	.89
150	15.2	.82	159.4	-.02	1.96	.65
200	18.7	.65	154.9	-.06	2.29	.42
250	21.4	.58	148.9	-.09	2.49	.30
300	23.8	.56	142.8	-.11	2.64	.24
350	25.9	.55	137.3	-.12	2.74	.20
400	27.9	.56	132.1	-.13	2.82	.17
450	29.8	.57	127.5	-.14	2.89	.15
500	31.6	.63	123.3	-.14	3.22	.12
750	40.3	.63	107.2	-.16	3.43	.08
1,000	48.6	.68	96.2	-.17	3.56	.06
2,000	80.9	.79	75.9	-.18	3.96	.04
3,000	112.8	.85	61.4	-.18	4.29	.03

1/ Gross domestic product equivalent.

2/ Equation 1.

3/ Equation 5.

4/ Equation 8.

5/ Portion of animal feed in total domestic disappearance of all grain.

Equation 13.

Note: z = infinity.

Table 55.--Critical ranges in the development sequence of the world grain-livestock economy

Human consumption per capita		Grain allo- cation to livestock	Grain-meat ratio	Income range per capita
Grain	Meat			
Rising fast -- nearly propor- tionally to income	None	None	None	Under \$60
Rising	Under 10 kg. -- rising more than proportionally to income	Under 1 percent of domestic disappearance	Very low -- below 1.0	\$50-100
About level	10 to 20 kg. -- rising proportionally to income	1-12 percent of domestic disappearance	Low -- but doubles to about 2.0	\$100-200
Falling	Moderate to high -- rising at 60-80 per- cent of income rise	Rising from 12- 75 percent of domestic dis- appearance -- about propor- tionally to rise in meat consumption per capita	Moderate to high -- doubles again to over 4.0	\$200-3000
Critical value A	Minimum income elasticity of meat consump- tion -- .55			(\$350)
Critical value B		Minimum income elasticity of feed grain share -- .55		(\$500)

Source: Table 54 and text.

ratio is nonexistent. At this lower limit of human existence, grain consumption for food is found to be rising at a rate almost proportional to the rate of growth in per capita income.

In the income range of \$50 to \$100 per capita, with grain consumption rising more gently, the increase in meat consumption -- at the low level of less than 10 kilograms a year -- is more than proportional to the rise in income. The amount of grain devoted to livestock production is very low -- less than 1 percent of domestic disappearance -- and the grain-meat ratio is also low.

Above this level, in the income range of \$100 to \$200 per capita, grain consumption for food becomes stationary, with respect to income, at about 150 to 160 kilograms per person annually, but meat consumption rises in proportion to income, doubling from 10 to about 20 kilograms per person per year. The intensity of grain feeding of livestock doubles, reaching the order of 2 kilograms of grain for each kilogram of meat produced. The grain allocation to livestock surges from 1 percent to 12 percent of total domestic disappearance.

From this level onward, in the income range of \$200 to \$3,000, per capita grain consumption for food tends to decline as income grows, while the rise in meat consumption loses intensity and continues to grow at a rate that is only 60 to 80 percent of the rate of income growth. Above this range, the grain-meat ratio again doubles to the order of 4 kilograms of grain for each kilogram of meat produced, and the allocation of grain to livestock climbs from 12 percent to 75 percent of all grain used. In the higher income levels in this range -- above \$500 per capita -- the increase in the feed grain share tends to be about proportional to the rise in per capita meat consumption.

The computations summarized above are based on less than perfect data, and more refined figures might not bear out some of the tentative conclusions this analysis suggests. In the extreme low-income ranges, there seem to be serious departures from homogeneity in the consumption surface that is the object of analysis in the equations fitted to human consumption data for both grain and meat. Some tentative observations are:

There is a range where meat is not in the effective field of choice;

A range exists in which meat consumption per capita rises in greater proportion than income;

This second range occurs while per capita grain consumption for food is rising with respect to income;

This second range merges with one in which grain consumption for food is stationary, with respect to income, while meat consumption rises in proportion to income; and

Beyond these ranges, there appears a range of falling grain consumption for food, combined with a moderately rising meat consumption in regard to income.

These observations suggest that the world meat-grain consumption surface, if one exists at all, must possess a very special configuration. That two such

basic commodity groups as the grains and meats should have such characteristics as those just mentioned suggests further that the roles of these commodities shift greatly through the lower income ranges. This suggestion, in turn, raises the question as to the significance of the "income" concept in such low ranges apart from the fact of possession of these very commodities themselves. Where income and commodity are no longer distinguishable, the concept of money, or numeraire, would seem to lose much of its significance, and one would be left with only a concept of "real income" defined not in terms of abstract money but of specific commodities. Such a reappraisal of concepts, then, also calls into question the significance of "markets" and "prices" in this extreme low-income context.

Potential Demand for Feed Grain -- Illustrations

The material developed in the foregoing sections permits some tentative answers to a number of common but difficult questions on the implications of economic development for growing demand for meat and feed grain.

The meat consumption relationship enables postulated developments in real per capita income to be translated into demand for meat in answer to such a question as: What effect would an increase of Z percent in real per capita income have on meat consumption in country X? In turn, use of the grain-meat ratio permits estimates of answers to such a question as: How much additional feed grain might it take to provide the meat to raise per capita meat consumption to a certain level?

The grain-meat ratios used in these calculations for determining the additional feed grain that is needed are not feeding rates in the usual sense, since they do not refer to total feed employed. These ratios convert only between meat output and the grain component of the feeding ration. In regions where livestock rely mainly on grazing or scavenging, the grain-meat ratio would be low. High efficiency in feed-energy conversion would also make the ratio low.

Example 1: Japan

Japan's 1962 real per capita income is equivalent to \$520 at prices and foreign exchange rates of the same year. Its per capita meat consumption of 6.4 kilograms a year is 26 kilograms short of the expected quantity -- 32.4 kilograms -- for a country of this degree of affluence, as calculated from the relationship depicted in figure 1. If it is assumed that the 26-kilogram gap between expected Japanese and world levels of per capita meat consumption will continue, a level of 35 kilograms per capita can be calculated for the world at a real annual per capita income equivalent to \$620. For Japan, the 35-kilogram level would tend to be associated with 9 kilograms of per capita meat consumption, which is approximately the meat-consumption level of the Philippines. Thus, we conclude that a 2.5 kilogram-increase in Japanese per capita meat consumption would tend to be associated with use of an additional 1.4 million tons of feed grain, if a grain-meat conversion rate of 5.5 is applied, and that such an increase would entail a 19- or 20-percent increase in per capita income.

Similar reasoning leads to the conclusion that a per capita annual income equivalent to \$750, associated with a level of world per capita meat consumption of 40 kilograms, would raise Japan's annual meat consumption to 14 kilograms per person, Taiwan's level. This rise implies an additional 750,000 tons of meat, or 4.13 additional tons of feed grain, and presupposes a 44-percent rise in per capita income.

Example 2: Indonesia

With a 1962 per capita income equivalent to \$69, Indonesia's per capita meat consumption of 5.7 kilograms was 1.8 kilograms above per capita meat consumption for the world at that income. An income equivalent to \$75 a year, associated with a per capita meat consumption estimated for the world at 5.4 kilograms, is calculated as necessary to bring Indonesian meat consumption to a level comparable to the average of the Southeast Asia-Pacific area. Similarly, an income equivalent to \$125 a year is estimated to bring Indonesia's meat consumption to the per capita level of Taiwan.

Thus, if a grain-meat conversion rate of 3 is plausible, a 9-percent increase in real per capita income is needed to bring Indonesia's meat consumption to the area average and would create demand for an estimated additional 500,000 tons of feed grain. Achieving the Taiwan level of meat consumption and opening the market for 3 million additional tons of feed grain presupposes an 80-percent rise in per capita income.

Example 3: India

At an average per capita income of \$78, India's annual meat consumption of only 1.4 kilograms per person is 4.5 kilograms less than the expected world average at this income, 5.9 kilograms. Per capita incomes equivalent to \$90 and \$100 are associated with per capita meat consumption levels equivalent to those of Pakistan and Indonesia, when allowance is made for the 4.5-kilogram difference. A \$200 income level, associated with 18.5 kilograms of per capita meat consumption, is equivalent to the 14 kilograms for Taiwan, when this difference is subtracted.

India's low meat consumption is consistent with the country's cultural constraints but does not preclude a significant income elasticity of demand for meat, which may be well over 1.0 in the income range under consideration, suggested in table 54.

Thus, a 15-percent rise in average personal income is implied in enabling India to move to Pakistan's per capita meat consumption, thereby activating demand for an additional 3.5 million tons of feed grain, when a grain-meat ratio of 3 is assumed. A 28-percent rise in per capita income underlies a rise to Indonesia's meat-consumption level, with the opening of a potential 7 million ton-feed grain market. A 2½-fold increase in per capita income to bring India to Taiwan's level of meat consumption is the implied condition for tapping that latent 20.5 million ton-feed grain market.

Example 4: The World

Raising world meat consumption by 1 kilogram a year per person would be equivalent to providing everyone with 10 more medium-sized hamburgers a year and would result in a world average annual meat consumption of 26 kilograms. This is equivalent to an increase in total meat consumption of 3.7 million tons. Assuming the world average grain-meat ratio of 3.55 would hold for the increase, the feed grain equivalent would be over 13 million tons.

In the less developed countries, 1.7 million tons of additional meat are necessary for raising consumption by 1 kilogram for each person. At the present grain-meat ratio of only 1.3, the required additional feed grain is 2.2 million tons. However, to accomplish such an increase in the less developed countries, a higher conversion rate might have to be allowed for, and the world average grain-meat ratio of 3.55 might prove appropriate. If so, 6 million tons of feed grain would be necessary.

But increased meat consumption and grain use by livestock imply rising income. The extent of this rise can be estimated by means of the relationships underlying table 54. The conclusion then follows: a rise by 1 kilogram per person in world meat consumption implies an 8-percent increase in average income per person around the world.

PROJECTED FEED GRAIN DEMAND

The Calculations

Methodology

The relationships composing the main sequence provide a basis for projecting the derived demand for feed grain in the world for 1980. Mainly through use of Equations 1, 5, and 10, attention is focused on developments in the meat and livestock sector and their implications for affecting the demand for feed grain. The results are presented in several variants ranging from Case I (constant per capita consumption of meat) through Case VII (constant income elasticity of per capita consumption of meat). The following steps are involved in the estimating process; some can be calculated, while others can only be taken by explicit assumption:

- Estimating per capita and then total meat consumption for each region of the world, and then projecting it to 1980;
- Postulating meat consumption by category of meat for each region, currently and in 1980;
- Estimating the degree of self-sufficiency in meat for each region, currently and in 1980;
- Estimating meat production for each region, currently and in 1980;
- Postulating changes in joint-product ratios involving meat, eggs, and milk for each region, currently and in 1980;
- On the basis of conditions affecting meat consumption patterns and joint-product ratios, estimating current grain-meat ratios by region, and then projecting them to 1980; and
- Deriving current and 1980 consumption of feed grain by livestock through use of current and estimated 1980 grain-meat ratios applied to current and estimated 1980 livestock production.

Converting the estimates of feed grain consumption thus obtained into estimates of coarse grain demand involves several additional steps;

- Estimating per capita and then total human consumption of grain for each region, currently and in 1980;
- Estimating the grain requirements for seed, industrial, and other uses for each region, currently and in 1980;
- Estimating the share that coarse grain is to total grain in human food, livestock feed, and other uses, by region, currently and in 1980; and finally;

- Estimating coarse grain consumption by applying these estimated shares to the estimates of human food, livestock feed, and other uses of grain obtained in the steps above.

Figure 16 illustrates the relationships among these elements in the projection framework. In the following sections, this framework is used to analyze future consumption of feed grain and coarse grain.

In interpreting the following projections, it should be remembered that the benchmarks of the projections are, for most regions, multiyear average figures extracted from commodity balances and reconciled to illuminate the entire pattern in the balances. These benchmarks are not necessarily official figures of the countries involved.

Income, Population, and Prices

The projections of per capita and total real income and of population underlying the meat, feed grain, and industrial grain projections are those serving as the basis for projections in the entire series of world demand studies of which this report forms a part. The projections are depicted in the lower panels of figure 17 and set forth in tables 56 through 59. Per capita real income for the developed countries as a group is projected to rise by 58 percent between 1965 and 1980. It is expected to increase by 64 percent in the central plan countries and to grow by 37 percent in the less developed countries. In the same period, population, on the other hand, is projected to increase by 17 percent in the developed countries; by 30 percent in the central plan countries; and by 47 percent in the less developed countries. World per capita real income is expected to rise by 45 percent from 1965 to 1980, while population is advancing by 35 percent.

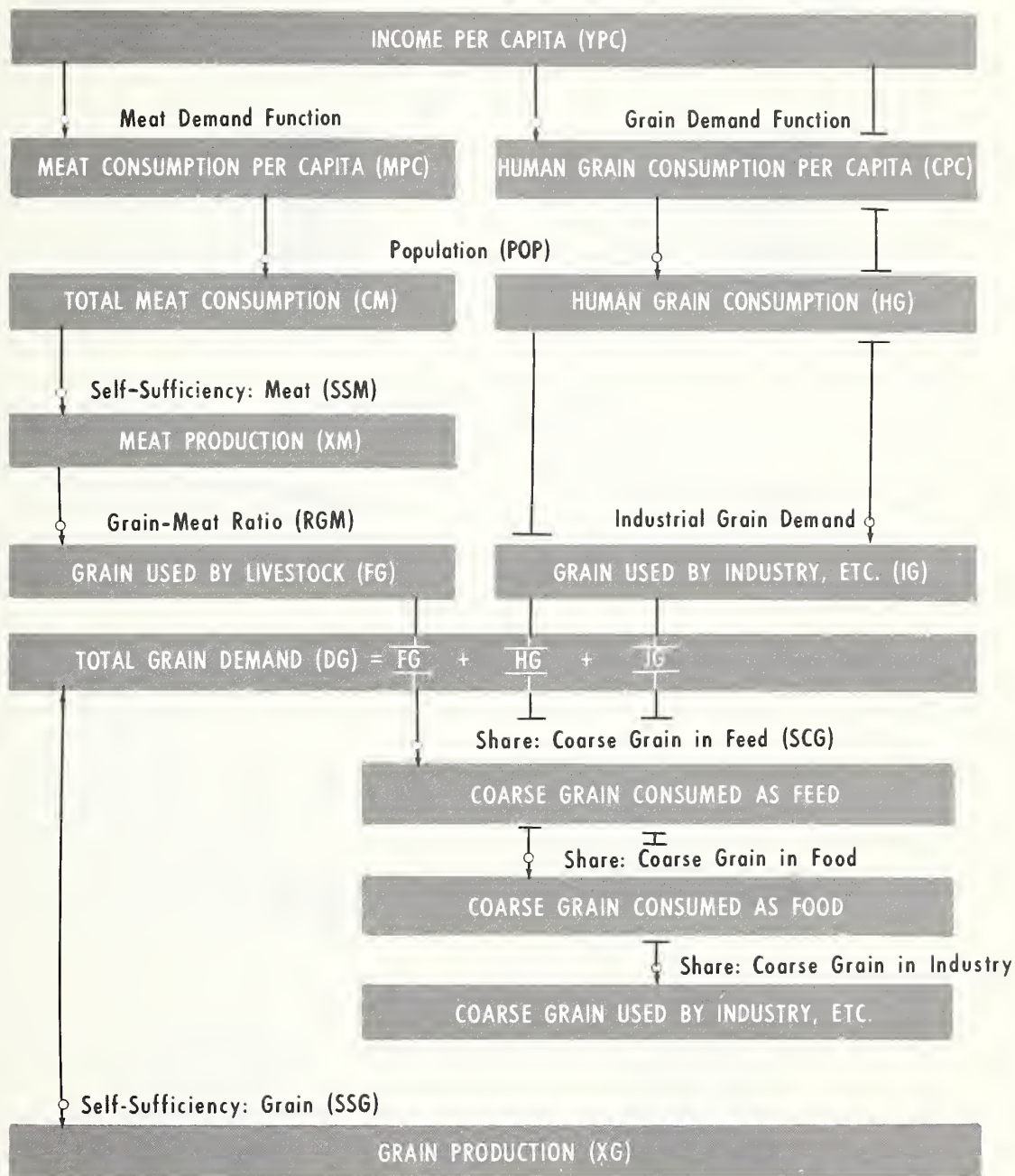
The projection formulas employed below are net (free) of price effects in their income terms. The projections are made in terms of real income and real prices, which implies that (1) nominal prices do not change over the projection period or (2) that current nominal income and prices move homogeneously over time with respect to each other and (3) that a particularly important ratio -- the meat-grain price -- is stable.

Meat Consumption

Income elasticities of demand for meat that express per capita consumption as a function of per capita income have been computed from meat consumption Equations 1 and 4 and are shown as columns (1) and (3) of table 57. Projections have been made using a set of adjusted elasticity coefficients, column (2). Principal adjustments of these coefficients have the effect of (1) restricting elasticities among less developed countries to a maximum of 1.0; (2) restricting the U.S. coefficient to a level that would not take U.S. per capita meat consumption into unrealistic levels higher than Australia, New Zealand, and Argentina; and (3) boosting the elasticity for Japan to the EEC-EFTA level.

Through use of the above set of elasticity coefficients, together with the income and population projections previously described, per capita meat consumption in the developed countries has been calculated to rise from 59.3 and 64.2 kilograms per annum in 1962 and 1965, respectively, to 78.9 kilograms

PROJECTION SCHEME FOR FEED GRAIN DEMAND



NOTE: INITIALS IN PARENTHESES ARE SYMBOLS FOR ITEMS THEY FOLLOW.
 ┌─┐ MEANS THE FUNCTION BYPASSES THE ITEM. WHEN INSIDE THE BOX,
 ┌─┐ MEANS IDENTITY.
 ○ MEANS A CONVERSION OF ONE ITEM INTO ANOTHER.

Figure 16

WORLD: GRAIN AND MEAT CONSUMPTION INCOME AND POPULATION, 1965 AND 1980

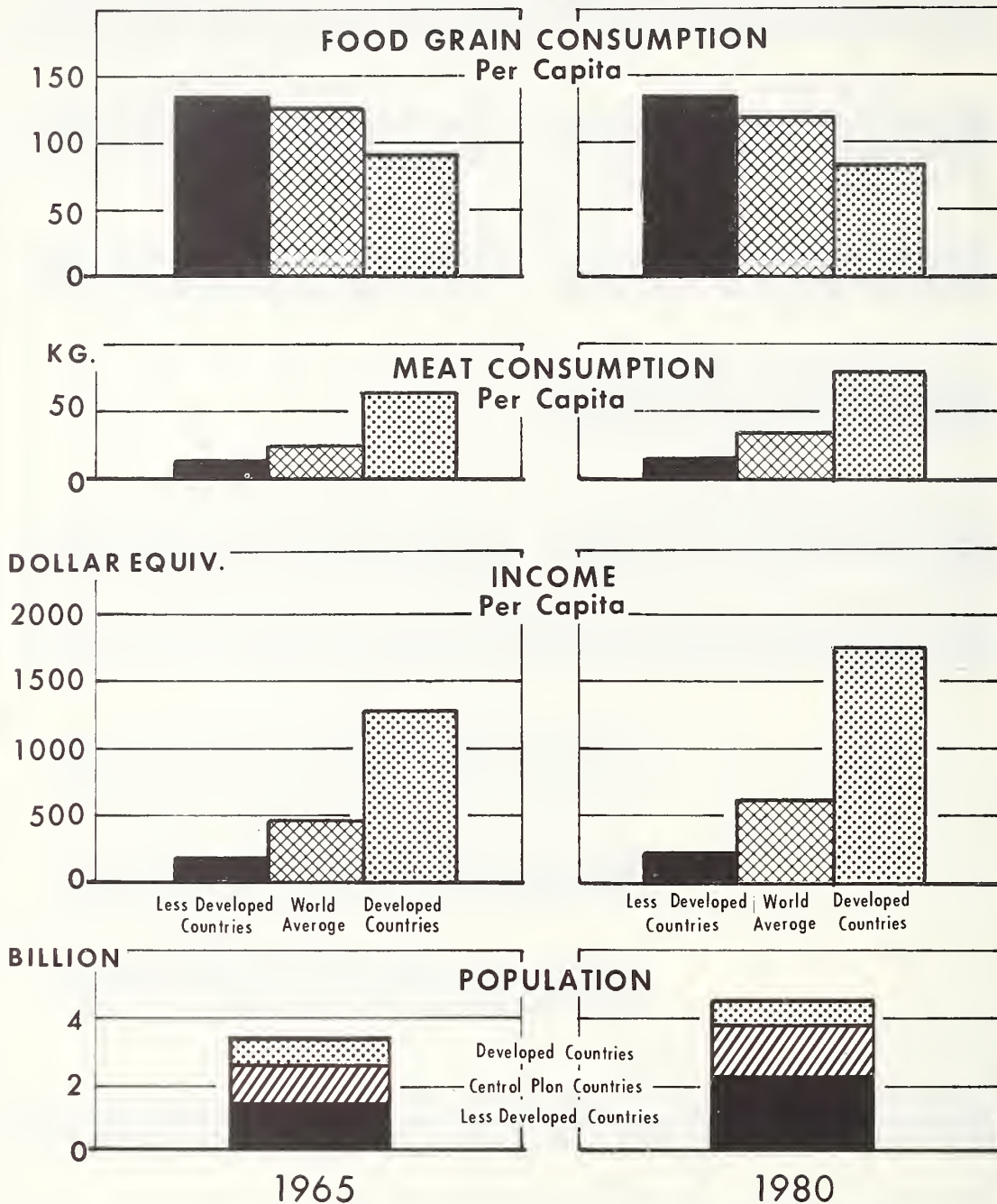


Figure 17

Table 57.--World: Projected per capita real income by regions, 1970, 1975, and 1980

Region or country	Projected per capita real income			Change from 1965			Income measure
	1970	1975	1980	1970	1975	1980	
	-----Dollar equiv.-----			-- Pct. of 1965 --			
Developed countries	1,285	1,516	1,729	117.6	138.7	158.2	CE
United States	2,364	2,716	3,029	115.7	132.9	148.2	CE
Canada	1,562	1,754	1,942	112.8	126.6	140.2	CE
European Community	955	1,141	1,386	118.5	141.6	171.9	CE
EFTA*	1,016	1,148	1,355	112.4	126.7	149.6	CE
Other Western Europe	453	575	693	123.4	156.7	188.8	CE
Japan	503	706	992	141.3	198.3	278.7	CE
South African Republic ..	434	478	520	108.2	119.2	129.7	CE
Oceania	1,144	1,281	1,421	111.8	125.2	138.9	CE
Central plan countries	402	473	559	117.9	138.9	164.3	NMP
Soviet Union	1,176	1,448	1,802	123.4	151.9	189.1	NMP
Eastern Europe	856	1,043	1,273	121.9	148.6	181.3	NMP
Communist Asia	120	133	147	111.1	123.1	136.1	NMP
Less developed countries ...	183	201	225	111.6	122.8	137.5	GNP
Middle America	439	492	555	114.3	128.1	144.5	GNP
East South America**	366	405	450	136.1	150.6	167.3	GNP
West South America	341	386	440	105.6	119.5	136.2	GNP
North Africa	189	207	232	107.4	117.6	131.8	GNP
West Africa	116	126	138	106.4	115.6	126.6	GNP
East Africa	107	115	126	110.3	118.6	129.9	GNP
West Asia	341	386	440	112.5	127.4	145.2	GNP
South Asia	108	117	130	108.0	117.0	130.0	GNP
East Asia-Pacific Islands :	153	165	181	108.5	117.0	128.4	GNP
Southeast Asia	112	123	136	107.7	118.3	130.8	GNP
World total	465	529	593	114.0	129.6	145.4	
* Of which: U.K.	1,028	1,188	1,404	104.0	120.2	142.1	CE
** Of which: Argentina	767	822	920	145.8	156.3	174.9	GNP

Note: Income is expressed in the equivalent of 1965 dollars. CE is consumer expenditure; NMP is net materials product; and GNP is gross national product. Uniform income projections were adopted for all the studies on demand prospects for agricultural exports of less developed countries.

Source: (20).

Table 58.--World: Projected total real income, by regions, 1970, 1975, and 1980

Region or country	Projected total real income			Change from 1965			Income measure
	1970	1975	1980	1970	1975	1980	
	----- Mil. dol. equiv. -----			-- Pct. of 1965 --			
Developed countries	902,269	1,120,263	1,348,703	123.6	153.4	184.7	CE
United States	491,005	606,047	730,287	123.4	152.3	184.6	CE
Canada	33,501	41,350	50,551	121.8	152.3	186.2	CE
European Community	179,077	220,363	274,955	122.2	150.6	187.9	CE
EFTA*	97,964	114,434	139,649	116.0	135.5	165.3	CE
Other Western Europe	23,114	30,469	38,188	128.5	169.4	212.3	CE
Japan	51,260	75,260	75,318	146.9	215.7	215.9	CE
South African Republic ..	8,929	11,127	13,866	124.6	115.2	193.5	CE
Oceania	17,419	21,213	25,883	121.7	148.2	180.8	CE
Central plan countries	502,506	645,018	835,170	128.6	165.1	213.8	NMP
Soviet Union	288,503	377,062	499,852	131.3	117.6	227.5	NMP
Eastern Europe	108,852	138,789	176,649	127.6	162.7	207.0	NMP
Communist Asia	105,151	129,167	158,669	122.8	150.8	185.3	NMP
Less developed countries ...	320,325	401,061	510,614	126.7	158.7	202.0	GNP
Middle America	40,980	53,757	71,265	133.2	174.8	166.0	GNP
East South America**	40,567	51,702	66,009	127.4	162.3	207.2	GNP
West South America	19,291	24,278	31,034	125.5	158.0	201.9	GNP
North Africa	16,239	20,587	26,791	123.6	156.7	204.0	GNP
West Africa	17,395	21,508	26,899	120.4	148.8	186.2	GNP
East Africa	10,094	12,318	15,237	122.2	149.2	184.6	GNP
West Asia	33,943	44,089	57,853	127.4	165.4	217.1	GNP
South Asia	78,278	95,689	119,180	122.2	149.4	186.0	GNP
East Asia-Pacific Islands :	34,575	42,780	54,188	123.1	152.4	193.0	GNP
Southeast Asia	10,357	12,784	16,042	122.9	151.7	190.3	GNP
World total	1,725,100	2,166,342	2,694,487	125.6	157.7	196.2	
* Of which: U.K.	61,300	69,694	85,202	113.7	129.2	158.0	CE
** Of which: Argentina ...	18,606	21,569	26,116	158.3	183.6	222.3	GNP

Note: Income is expressed in the equivalent of 1965 dollars. CE is consumer expenditure; NMP is net materials product; and GNP is gross national product. Uniform income projections were adopted for all the studies on demand prospects for agricultural exports of less developed countries.

Source: (20).

Table 59.--World: Projected population by regions, 1970, 1975, and 1980

Region or country	Projected population			Change from 1965		
	1970	1975	1980	1970	1975	1980
	<u>Mil.</u>			<u>Pct. of 1965</u>		
Developed countries	701,885	739,094	780,095	105.1	110.8	116.8
United States	207,725	223,180	241,079	106.8	114.7	123.9
Canada	21,451	23,581	26,024	109.4	112.3	132.7
European Community	187,591	193,182	198,385	103.3	106.4	109.2
EFTA*	96,420	99,701	103,037	103.4	106.9	110.5
Other Western Europe	50,999	52,959	55,142	104.0	108.0	112.4
Japan	101,918	106,647	111,563	104.0	108.8	113.8
South African Republic ...	20,554	23,292	26,676	115.0	130.4	149.3
Oceania	15,227	16,554	18,216	108.8	118.2	130.1
Central plan countries	1,251,428	1,364,550	1,493,152	109.0	118.9	130.1
Soviet Union	245,266	260,350	279,325	106.4	112.9	120.3
Eastern Europe	127,179	133,083	138,763	104.7	109.6	114.3
Communist Asia	878,983	971,117	1,077,064	110.5	122.1	135.3
Less developed countries	1,753,417	2,094,995	2,268,511	113.6	135.7	146.9
Middle America	93,402	109,323	128,508	116.6	136.5	160.4
East South America**	134,991	153,859	174,923	114.0	129.9	147.7
West South America	54,555	62,710	72,260	114.5	131.6	151.7
North Africa	86,016	99,580	115,284	115.3	133.5	154.5
West Africa	149,546	170,021	194,463	112.8	128.3	146.7
East Africa	94,648	107,085	121,157	111.5	126.1	142.7
West Asia	99,597	114,203	131,372	88.2	121.8	149.4
South Asia	722,172	815,439	913,655	113.2	127.8	143.2
East Asia-Pacific Islands :	226,333	258,508	298,920	114.0	130.2	150.5
Southeast Asia	92,157	104,267	117,969	113.7	128.6	145.5
World total	3,706,730	4,198,639	4,541,758	110.3	120.6	135.2
* Of which: U.K.	56,610	58,658	60,690	103.7	107.4	111.2
** Of which: Argentina ...	24,284	26,255	25,379	108.5	117.5	127.0

Note: Uniform population projections were adopted for all the studies on demand prospects for agricultural exports of less developed countries.

Source: (20).

in 1980 (see fig. 17 and table 60). In the central plan countries, from 21.9 kilograms in 1962 and 24.5 kilograms in 1965, per capita meat consumption is expected to grow to 32.3 kilograms in 1980. Such meat consumption in the less developed countries is projected to grow by 1 kilogram each 5 years, from 10.6 and 11.6 kilograms in 1962 and 1965, respectively, to 14.6 kilograms in 1980.

For the 1965-80 period, these per capita meat-consumption figures imply a 42-percent increase in total meat consumption in the developed countries, from 41.8 million to 59.3 million tons; a 65-percent increase in the central plan countries, from 27.7 million to 45.7 million tons; and an 84-percent increase in the less developed countries, from 18.0 million to 26.7 million tons.

The implications for world meat consumption are that the per capita average moves from 27.0 to 34.8 kilograms over the 15-year period, while total meat consumption grows from 87.6 million to 138.1 million metric tons, a 68-percent increase.

Meat Production

Given estimated meat consumption, projected rates of self-sufficiency in meat by region applied to the consumption levels yield estimated meat production by region. The basic projection, displayed in tables 61 and 62, assumes that future rates of self-sufficiency will remain as they are currently.

This important assumption bears heavily on the projection obtained. In essence, it implies that world trade patterns in livestock and meat will continue to flow in customary directions and grow in proportion to world demand. This assumption seems plausible for the less developed countries where the estimates thus far quantified typically indicate "0" net trade on "100 percent" net self-sufficiency in meat. For the developed countries, where the assumption can be examined with data, this assumption also appears plausible at least as an important projection variant that is not following short-term effects of commodity cycles but quantifying a future norm. Furthermore, the low coefficient of determination obtained for Equation 20 raises a question as to the validity of projecting net trade or self-sufficiency in relation to income.

Grain-Meat Ratios

For each region, the ratio of grain consumed by livestock to meat produced has been calculated. This ratio has also been analyzed by cross-sectional multiple regression for the world and estimated alternatively (1) as a function of per capita income and its inverse, among other variables, and (2) as a function of percentage components of principal meat products (such as bovine meat and poultry) and the joint-product ratio between meat and milk. The basic projection contains two variants. The first assumes that the grain-meat ratio, at the regional level, does not change during the projection period. This variant tacitly assumes that grain feeding does not intensify with advancing income and that the percentage components of meat and livestock products do not change. The left panel in figure 10 shows representative ratios in this projection. The second variant, shown in the right panel, allows the grain-meat ratio to vary in accordance with projected per capita income. Table 49

Table 60.--World: Meat consumption, per capita and total, by regions, 1962, estimated 1965, and projected 1970, 1975, and 1980 -- basic projection

Region or country	Per capita						Total					
	1962	1965	1970	1975	1980		1962	1965	1970	1975	1980	
	Kg.						1,000 m.t.					
Developed countries	59.3	64.2	69.1	74.0	78.9		37,758	41,847	46,952	52,717	59,298	
United States	89.5	95.0	100.0	105.0	110.0		16,706	18,484	20,772	23,434	26,519	
Canada	76.6	82.0	87.4	92.8	98.2		1,425	1,607	1,875	2,188	2,555	
European Community	58.3	62.4	66.5	70.6	74.7		10,228	11,331	12,475	13,639	14,819	
EFTA*	60.8	64.8	68.8	72.8	76.8		5,539	6,042	6,634	7,258	7,913	
Other Western Europe	22.1	24.6	27.1	29.6	32.1		1,060	1,206	1,382	1,567	1,770	
Japan	6.4	7.5	9.6	12.7	16.9		608	735	978	1,354	1,885	
South African Republic ..	44.5	50.5	56.5	62.5	68.5		741	902	1,161	1,456	1,827	
Oceania	110.0	110.0	110.0	110.0	110.0		1,451	1,540	1,675	1,821	2,010	
Central plan countries	21.9	24.5	27.1	29.7	32.3		23,648	27,706	32,991	39,168	45,656	
Soviet Union	37.5	42.5	47.5	52.5	57.5		8,305	9,800	11,650	13,931	15,946	
Eastern Europe	40.8	45.9	51.0	56.1	61.2		4,830	5,574	6,486	7,466	8,492	
Communist Asia	14.1	15.5	16.9	18.3	19.7		10,513	12,332	14,855	17,771	21,218	
Less developed countries	10.6	11.6	12.6	13.6	14.6		15,062	18,028	21,420	26,752	33,170	
Middle America	17.8	19.5	21.2	22.9	24.6		1,297	1,561	1,980	2,503	3,161	
East South America**	40.5	42.8	45.1	47.4	49.7		4,424	5,068	4,994	6,048	7,283	
West South America	32.9	35.3	37.7	40.1	42.5		1,439	1,682	2,057	2,515	3,071	
North Africa	12.0	13.6	15.2	16.8	18.4		831	1,015	1,307	1,673	2,121	
West Africa	9.3	10.7	12.1	13.5	14.9		1,142	1,418	1,809	2,295	2,897	
East Africa	17.6	20.0	22.4	24.8	27.2		1,397	1,698	2,120	2,676	3,295	
West Asia	17.8	20.3	22.8	25.3	27.8		1,445	1,784	2,271	2,889	3,652	
South Asia	2.2	2.4	2.6	2.8	3.0		1,306	1,531	1,878	2,283	2,741	
East Asia-Pacific Islands ..	7.2	8.7	10.2	11.7	13.2		1,323	1,728	2,309	3,046	3,946	
Southeast Asia	6.1	6.7	7.3	7.9	8.5		458	543	695	824	1,003	
World total	24.4	27.0	29.6	32.22	34.8		76,468	87,581	101,363	118,637	138,124	
* Of which: U.K.	70.3	74.0	77.7	81.4	85.1		3,758	4,040	4,391	4,775	5,065	
** Of which: Argentina	99.6	102.0	104.0	106.0	108.0		2,126	2,280	2,522	2,783	3,065	

Note: Assumptions--Population and real income develop as in tables 56 to 59; income elasticities of demand for meat are based on those of table 47; projection equations for per capita meat consumption are linear in the variables: U.S. figure is held to the levels of Oceania and Argentina, and Japan figure is projected with constant income elasticity.

Source: Tables 46, 47, 56, 57, and 59.

Table 61.--World: Meat consumption (CM), self-sufficiency (SSM), meat production (XM), grain-meat ratio (RGM), and grain consumption by livestock (FG), by regions, 1962 and 1965

Region or country	1962					1965				
	CM	SSM	XM	RGM	FG	CM	SSM	XM	RGM	FG
	1,000		1,000	Rate	1,000	1,000		1,000	Rate	1,000
	m.t.	Pct.	m.t.		m.t.	m.t.	Pct.	m.t.		m.t.
Developed countries	37,758	(99.4)	37,542	(4.66)	175,055	41,944	(99.3)	41,666	(4.67)	194,746
United States	16,706	99.7	16,656	5.55	92,441	18,581	99.7	18,525	5.55	102,814
Canada	1,425	99.0	1,411	6.94	9,792	1,607	99.0	1,591	6.94	11,042
European Community	10,228	93.1	9,522	4.11	39,135	11,331	93.1	10,549	4.11	43,356
EFTA*	5,539	88.3	4,891	4.32	21,129	6,042	88.3	5,335	4.32	23,047
Other Western Europe	1,060	124.8	1,322	5.42	7,165	1,206	124.8	1,505	5.42	8,157
Japan	608	92.9	564	5.49	3,096	735	92.9	683	5.49	3,750
South African Republic	741	95.5	685	1.35	925	902	95.5	834	1.35	1,126
Oceania	1,451	171.7	2,491	.55	1,372	1,540	171.7	2,644	.55	1,454
Central plan countries	23,648	(100.5)	23,755	(3.24)	76,882	27,706	(100.4)	27,830	(3.24)	89,771
Soviet Union	8,305	100.3	8,330	3.35	27,902	9,800	100.3	9,829	3.35	32,927
Eastern Europe	4,830	101.7	4,912	6.59	32,370	5,574	101.7	5,669	6.59	37,359
Communist Asia	10,513	100.0	10,513	1.58	16,610	12,332	100.0	12,332	1.58	19,485
Less developed countries ...	15,062	(104.2)	15,701	(1.61)	25,208	17,947	(104.0)	18,666	(1.60)	29,777
Middle America	1,297	104.5	1,355	2.51	3,401	1,561	104.5	1,631	2.51	4,094
East South America**	4,424	113.3	5,012	2.07	10,375	4,984	113.3	5,647	2.07	11,689
West South America	1,439	98.3	1,415	.62	877	1,682	98.3	1,653	.62	1,025
North Africa	831	97.5	810	1.72	7,393	1,015	97.5	990	1.72	1,703
West Africa	1,142	99.1	1,132	.14	158	1,418	99.1	1,405	.14	197
East Africa	1,397	103.7	1,449	.35	507	1,698	103.7	1,761	.35	616
West Asia	1,445	99.0	1,430	4.35	6,216	1,784	99.0	1,766	4.35	7,682
South Asia	1,306	100.0	1,306	1.02	1,332	1,531	100.0	1,531	1.02	1,562
East Asia-Pacific Islands ..	1,323	98.7	1,306	.53	692	543	98.7	1,706	.53	404
Southeast Asia	458	106.1	486	.53	257		106.1	576	.53	305
World total	76,468	(100.7)	76,998	(3.60)	277,145	87,594	(100.6)	88,162	(3.64)	314,294
* Of which: U.K.	3,758	64.6	2,428	4.65	17,290	4,040	64.6	2,610	4.65	12,136
**Of which: Argentina ...	2,126	125.7	2,672	1.08	2,886	2,226	125.7	2,416	1.08	3,022

Note: U.S. figures for RGM and FG do not include grain sorghum.

Source: Tables 46, 60, and 63, and app. table 4.

Table 62.--World: Meat consumption (CM), self-sufficiency (SSM), meat production (XM), grain consumption (FG), grain-meat ratio (RGM), and grain consumption by livestock (FG), by regions, 1980

Region or country	Constant grain-meat ratios				Changing grain-meat ratios					
	CM	SSM	XM	RGM	FG	CM	SSM	XM	RGM	FG
	1,000		1,000		1,000	1,000		1,000		1,000
	m.t.	Pct.	m.t.	Rate	m.t.	m.t.	Pct.	m.t.	Rate	m.t.
Developed countries	61,384	(98.8)	60,665	(4.73)	281,741	61,384	(98.8)	60,665	(4.80)	291,069
United States	23,504	99.7	23,433	5.55	130,053	23,504	99.7	23,433	5.60	131,225
Canada	2,647	99.0	2,621	6.94	18,190	2,647	99.0	2,621	6.94	18,190
European Community	18,608	93.1	17,324	4.11	71,202	18,608	93.1	17,324	4.30	74,493
EFTA*	8,995	88.3	7,943	4.32	34,314	8,995	88.3	7,943	4.50	35,743
Other Western Europe	2,140	124.8	2,671	5.42	14,477	2,140	124.8	2,671	6.00	16,026
Japan	1,885	92.9	1,751	5.49	9,613	1,885	92.9	1,751	6.30	11,031
South African Republic	1,601	92.5	1,481	1.35	1,999	1,601	92.5	1,481	1.55	2,296
Oceania	2,004	171.7	3,441	.55	1,893	2,004	171.7	3,441	.60	2,065
Central plan countries	50,680	(100.4)	50,899	(3.19)	162,131	50,680	(100.4)	50,899	(3.51)	178,525
Soviet Union	18,387	100.3	18,442	3.35	61,781	18,387	100.3	18,422	3.60	66,391
Eastern Europe	9,630	101.7	9,794	6.59	64,542	9,630	101.7	9,794	6.59	64,542
Communist Asia	22,663	100.0	22,663	1.58	35,808	22,663	100.0	22,663	2.10	47,592
Less developed countries	30,893	(103.8)	31,851	(1.60)	49,808	30,893	(103.8)	31,851	(2.07)	65,849
Middle America	3,136	104.5	3,276	2.51	8,223	3,136	104.5	3,276	3.00	9,828
East South America**	6,323	113.3	7,164	2.07	14,829	6,323	113.3	7,164	2.70	19,343
West South America	3,071	98.3	3,019	.62	1,872	3,071	98.3	3,019	.75	2,264
North Africa	1,971	97.5	1,922	1.72	3,306	1,971	97.5	1,922	2.25	4,324
West Africa	2,625	99.1	2,601	.14	364	2,625	99.1	2,601	.21	546
East Africa	3,150	103.7	3,267	.35	1,143	3,150	103.7	3,267	.50	1,633
West Asia	3,455	99.0	3,420	1.35	14,877	3,455	99.0	3,420	5.20	17,784
South Asia	2,832	100.0	2,832	1.02	2,889	2,832	100.0	2,832	2.04	5,777
East Asia-Pacific Islands	3,292	98.7	3,249	.53	1,722	3,292	98.7	3,249	1.00	3,249
Southeast Asia	1,038	106.1	1,101	.53	583	1,038	100.1	1,101	1.00	1,101
World total	142,957	(100.5)	143,415	(3.50)	493,680	142,957	(100.5)	143,415	(3.73)	535,443
* Of which: U.K.	5,680	64.6	3,669	4.65	17,061	5,680	64.6	3,669	4.85	17,795
**Of which: Argentina	2,528	125.7	3,178	1.08	3,432	2,528	125.7	3,178	1.55	4,426

Note: U.S. figures for RGM and FG do not include grain sorghum.

Source: Tables 46, 60, and 63, and app. table 4.

(Kilograms of grain per kilogram of meat)

Source: App. table 4 and calculations based on table 54 and Equation 8.

sets forth the components of livestock production that underlie both current and projected ratios, as used in both variants of the basic projection. Table 63 gives the projected grain-meat ratios.

Grain Consumption by Livestock

The meat production figures presented in the above estimates multiplied by the grain-meat ratios explained in the preceding section yield two basic sets of projections of grain consumption by livestock that are presented in table 64 and illustrated in fig. 18.

Consumption of Coarse Grains

Moving from an estimate of the demand for feed grain to the demand for coarse grains involves estimating the projected human demand for grain and the demand for grain for industrial and other uses, and then breaking down in each of these uses the part for coarse grains and for other grains (namely, wheat and rice).

Grain Consumption by Humans

Per capita consumption of grain by humans has been estimated according to an approach analogous to that used earlier in projecting meat consumption. Income elasticities of per capita consumption of grain have been estimated from Equation 5, and are shown in table 48, column (1). For the developed countries, the elasticities computed from the equation were augmented by $-.10$, shown in column (2).

Employment of these elasticity coefficients, together with the per capita income projections presented above, gives projections of per capita grain consumption for food. From 1965 to 1980, per capita grain consumption is projected to decline from 92.3 to 77.8 kilograms per annum in the developed countries; from 153.9 to 143.0 kilograms in the central plan countries; and to hold unchanged at 133.8 kilograms in the less developed countries (tables 65 and 66).

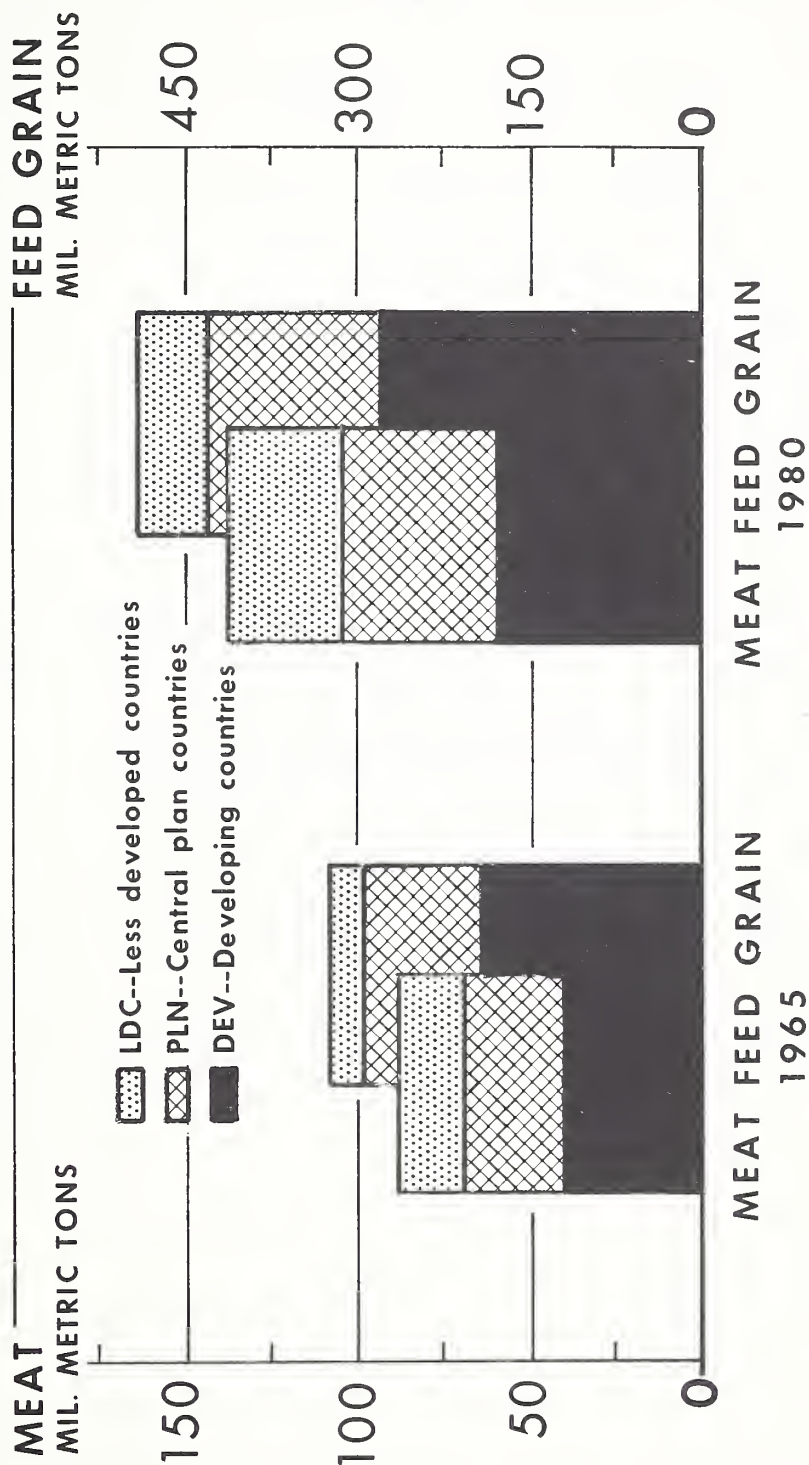
Other Uses of Grain

Use of grain for seed, industrial purposes, waste, and other purposes is expected to expand somewhat more rapidly than population growth. By 1980, the expansion is projected to have grown to a figure 20 percent greater than an expansion proportional to population would have attained. Projections to 1980 are shown in table 67.

Demand for Coarse Grain

Table 68 presents a set of percentages representing, for the regions of the world, the relative importance of coarse grain in total grain in the utilization categories into which the grain projections have been divided; namely, food, livestock feed, and all other uses combined. The table shows that the United States, leading the developed countries, uses coarse grain at the rate of 87 percent of total grain. West Africa, 89 percent, East Africa, 84 percent, and Middle America (Central America plus Mexico), 82 percent, are the other world leaders in the intensity of coarse grain use in total grain. The regions into which Asia has been divided for the study reported on here, range downward

WORLD: CONSUMPTION OF MEAT AND FEED GRAIN, 1965 AND 1980



U.S. DEPARTMENT OF AGRICULTURE

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Figure 18

Table 64.--World: Grain consumption by livestock, by region, 1962, estimated 1965, and projected 1970, 1975, and 1980 -- basic projection 1/

Region or country	Constant grain-meat ratios				Changing grain-meat ratios				
	1962	1965	1970	1975	1980	1965	1970	1975	1980
					1,000 m.t.				
Developed countries	175,055	194,746	218,278	246,184	277,003	195,534	221,210	251,056	285,416
United States	92,441	102,814	114,941	129,665	146,736	103,000	115,562	130,599	148,058
Canada	9,792	11,042	12,881	15,032	17,551	11,042	12,881	15,032	17,551
European Community	39,135	43,356	47,733	52,697	56,693	43,567	48,663	53,962	59,314
EFTA*	21,129	23,047	25,306	27,687	30,183	23,207	25,775	28,520	31,442
Other Western Europe	7,165	8,157	9,349	10,601	11,973	8,278	9,781	11,403	13,254
Japan	3,096	3,750	4,990	6,906	9,613	3,791	5,272	7,610	11,031
South African Republic	925	1,126	1,497	1,876	2,356	1,168	1,608	2,085	2,705
Oceania	1,372	1,454	1,581	1,720	1,898	1,481	1,668	1,845	2,061
Central plan countries	76,882	89,711	106,084	124,922	144,012	91,126	110,754	134,152	159,044
Soviet Union	27,902	32,927	39,145	46,806	53,577	33,419	40,547	49,461	57,575
Eastern Europe	32,370	37,359	43,468	50,038	56,911	37,359	43,468	50,038	56,911
Communist Asia	16,610	19,425	23,471	28,078	33,524	20,348	26,739	34,653	44,558
Less developed countries	25,208	29,777	34,662	43,202	53,549	30,987	39,435	53,350	70,766
Middle America	3,401	4,094	5,193	6,566	8,291	4,159	5,586	7,456	9,909
East South America**	10,375	11,687	11,712	14,183	17,082	12,141	13,296	17,473	22,280
West South America	877	1,025	1,252	1,533	1,872	1,074	1,374	1,780	2,264
North Africa	1,393	1,703	2,191	2,805	3,557	1,782	2,484	3,425	4,653
West Africa	158	197	251	318	402	211	305	432	603
East Africa	507	616	769	971	1,196	657	923	1,277	1,708
West Asia	6,216	7,682	9,779	12,441	15,725	7,947	10,633	14,214	18,798
South Asia	1,332	1,562	1,916	2,329	2,796	1,761	2,723	3,995	5,592
East Asia-Pacific Islands	692	904	1,208	1,593	2,064	938	1,595	2,555	3,895
Southeast Asia	257	305	391	463	564	317	516	743	1,064
World total	277,145	314,234	359,024	414,308	474,564	317,647	371,245	438,558	515,226
* Of which: U.K.	11,290	12,136	13,192	14,345	15,517	12,267	13,476	14,808	16,184
**Of which: Argentina	2,886	3,022	3,424	3,778	4,161	3,218	4,089	5,002	5,972

1/ Constant and progressively changing grain-meat ratios.

Note: U.S. figures do not include grain sorghum. Source: Tables 61, and 62, and similar computations.

Table 65.--World: Grain consumption by humans, per capita by region, 1962, estimated 1965, and projected 1970, 1975, and 1980 1/

Region or country	1962	Alternative based on computed elasticities				Alternative based on augmented elasticities			
		1965	1970	1975	1980	1965	1970	1975	1980
Kg.									
Developed countries	98.0	95.9	93.0	89.6	86.4	92.3	87.9	82.7	77.8
United States	66.0	64.5	62.7	60.7	58.9	63.7	60.9	57.8	55.1
Canada	66.3	64.9	63.4	61.8	60.2	64.1	61.8	59.3	56.9
European Community	102.0	100.2	97.1	93.1	88.0	99.2	94.2	88.1	79.9
EFTA*	88.3	86.9	85.1	83.0	79.6	86.1	83.2	79.9	74.6
Other Western Europe	126.5	123.8	120.3	115.4	110.6	121.6	115.4	106.4	97.8
Japan	149.2	144.3	136.0	124.4	108.2	140.8	126.8	107.6	80.4
South African Republic ..	166.5	161.5	159.6	158.8	154.8	157.9	154.8	153.4	146.6
Oceania	83.6	82.0	81.2	78.5	76.6	81.1	78.5	75.6	72.6
Central plan countries	157.0	153.9	150.9	147.3	143.0	153.9	150.9	147.3	143.0
Soviet Union	171.4	165.6	159.4	151.9	142.0	165.6	159.4	151.9	142.0
Eastern Europe	155.4	150.7	145.7	139.7	132.3	150.7	145.7	139.7	132.3
Communist Asia	152.9	154.0	155.2	156.5	157.9	154.0	155.2	156.5	157.9
Less developed countries ..	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8
Middle America	126.8	124.6	122.8	121.1	119.1	124.6	122.8	121.1	119.1
East South America**	104.1	102.6	98.9	97.4	95.7	102.6	98.9	97.4	95.7
West South America	74.6	73.5	73.0	71.9	70.6	73.5	73.0	71.9	70.6
North Africa	146.2	146.2	146.2	146.2	146.2	146.2	146.2	146.2	146.2
West Africa	108.5	108.5	108.5	108.5	108.5	108.5	108.5	108.5	108.5
East Africa	130.6	132.4	133.8	134.8	136.4	132.4	133.8	134.8	136.4
West Asia	150.6	148.4	147.1	145.6	143.7	148.4	147.1	145.6	143.7
South Asia	143.3	145.5	147.2	149.2	152.0	145.5	147.2	149.2	152.0
East Asia-Pacific Islands:	131.3	133.2	133.0	133.8	134.8	133.2	133.0	133.8	134.8
Southeast Asia	149.8	151.5	152.9	154.8	157.1	151.5	152.9	154.8	157.1
World total	129.2	126.9	124.4	121.6	118.8	126.9	124.4	121.6	118.8
* Of which: U.K.	81.4	80.3	79.8	77.5	74.6	80.3	79.8	77.5	74.6
** Of which: Argentina ..	91.1	89.5	83.8	82.4	80.1	89.5	83.8	82.4	80.1

1/ Using alternatives based on (1) computed income elasticities and (2) income elasticities augmented by declining trend.

Source: Tables 46, 48, 56, and 57.

Table 66.--World: Grain consumption by humans, total, by region, 1962, estimated 1965, and projected 1970, 1975, and 1980 1/

Region or country	1962	Alternative based on computed elasticities				Alternative based on augmented elasticities			
		1965	1970	1975	1980	1965	1970	1975	1980
Developed countries	63,596	64,361	65,316	65,641	65,168	63,432	62,854	61,217	57,941
United States	12,319	12,550	13,024	13,547	14,247	12,394	12,650	12,900	13,327
Canada	1,233	1,272	1,360	1,457	1,567	1,257	1,326	1,398	1,481
European Community	17,894	18,196	18,215	17,985	17,458	18,041	17,671	17,019	15,851
EFTA*	8,044	8,103	8,205	8,275	8,202	8,028	8,022	7,966	7,686
Other Western Europe	6,068	6,071	6,135	6,112	6,099	5,963	5,885	5,635	5,393
Japan	14,163	14,136	13,861	13,267	12,071	13,793	12,923	11,475	8,970
South African Republic ..	2,772	2,885	3,280	3,699	4,129	2,821	3,182	3,573	3,911
Oceania	1,103	1,148	1,236	1,299	1,395	1,135	1,195	1,251	1,322
Central plan countries	170,362	179,010	194,043	210,119	227,807	179,010	194,043	210,119	227,807
Soviet Union	37,959	38,187	39,095	39,547	39,380	38,187	39,095	39,547	39,380
Eastern Europe	18,398	18,300	18,530	18,592	18,358	18,299	18,530	18,592	18,358
Communist Asia	119,005	122,523	136,418	151,980	170,069	122,523	136,418	151,980	170,069
Less developed countries ...	193,513	206,768	233,017	259,328	305,489	206,768	233,017	259,328	305,489
Middle America	9,242	9,978	11,470	13,239	15,305	9,978	11,470	13,239	15,305
East South America**	11,371	12,148	10,952	12,429	14,024	12,148	10,952	12,429	14,024
West South America	6,394	3,501	3,982	4,509	5,101	3,501	3,982	4,509	5,101
North Africa	10,120	10,907	12,575	7,248	16,854	10,907	12,575	7,248	16,854
West Africa	13,327	14,383	16,226	18,447	21,099	14,383	16,226	18,447	21,099
East Africa	10,365	11,239	12,664	14,435	16,526	11,239	12,664	14,435	16,526
West Asia	12,222	13,041	14,651	16,630	18,878	13,041	14,651	16,630	18,878
South Asia	85,098	92,838	106,304	121,663	138,875	92,838	106,304	121,663	138,875
East Asia-Pacific Islands:	29,124	26,453	30,102	34,588	40,294	26,453	30,102	34,588	40,294
Southeast Asia	11,250	12,280	14,091	16,140	18,533	12,280	14,091	16,140	18,533
World total	427,471	450,139	498,376	535,088	598,464	449,210	489,914	530,664	591,237
* Of which: U.K.	4,351	4,384	4,157	4,546	4,527	4,384	4,157	4,546	4,527
** Of which: Argentina ..	1,945	2,001	2,032	2,163	2,033	2,001	2,032	2,163	2,033

1/ Using alternatives based on (1) computed income elasticities and (2) income elasticities augmented by declining trend.

Source: Tables 56, 57, 59 and 65.

Table 67.--World: Grain use for industrial, seed, waste, and other purposes (excluding food or feed), by region, 1962, estimated 1965, and projected 1970, 1975, and 1980 ^{1/}

Region or country	1962	1965	1970	1975	1980
	(x1.03)	(x1.075)	(x1.14)	(x1.207)	
	1,000 m.t.				
Developed countries	47,404	50,642	55,664	62,232	69,821
United States	16,304	17,499	19,505	22,214	25,406
Canada	3,073	3,336	3,809	4,443	5,188
European Community	12,909	13,762	14,837	16,206	17,610
EFTA*	6,809	7,175	7,743	8,490	9,290
Other Western Europe	2,256	2,375	2,578	2,839	3,128
Japan	4,317	4,589	4,980	5,526	6,119
South African Republic ..	683	755	906	1,090	1,326
Oceania	1,053	1,151	1,306	1,424	1,754
Central plan countries	51,528	55,447	62,007	70,382	79,976
Soviet Union	27,480	29,465	32,721	36,819	41,538
Eastern Europe	10,598	11,200	12,239	13,587	15,002
Communist Asia	13,450	14,782	17,047	19,976	23,436
Less developed countries ...	39,502	43,904	51,535	61,466	74,679
Middle America	3,191	3,612	4,396	5,457	6,789
East South America**	3,237	3,614	3,772	4,313	5,243
West South America	780	874	1,045	1,273	1,555
North Africa	1,761	1,955	2,352	2,889	3,539
West Africa	1,672	1,858	2,188	2,639	3,194
East Africa	2,902	3,198	3,722	4,463	5,348
West Asia	5,176	5,774	6,828	7,784	10,109
South Asia	16,068	17,775	21,000	25,142	29,827
East Asia-Pacific Islands :	2,046	2,278	2,711	3,283	4,018
Southeast Asia	2,669	2,966	3,521	4,223	5,057
World total	138,434	149,993	169,206	194,080	224,476
* Of which: U.K.	3,680	3,870	4,285	4,600	5,043
** Of which: Argentina ...	1,740	1,876	2,125	2,441	2,793

^{1/} Assuming expansion slightly more than proportional to population.

Source: Tables 56 and 59, and calculations.

Table 68.--World: Relative importance of coarse grain to total grain in all uses, food, feed, and other purposes, by region, 1962

Region or country	All uses	Food	Feed	Industry and other
	<u>Percent</u>			
Developed countries	72.32	14.22	93.62	71.61
United States	86.55	17.14	98.84	84.21
Canada	72.45	8.78	86.84	57.02
European Community	57.95	10.38	86.24	68.96
EFTA*	69.04	23.20	88.69	85.79
Other Western Europe	46.87	4.07	97.73	56.57
Japan	23.29	6.20	86.24	31.57
South African Republic ...	77.93	68.37	98.54	75.78
Oceania	42.42	7.20	68.17	53.47
Central plan countries	47.57	26.86	91.73	52.16
Soviet Union	48.43	24.95	93.79	46.23
Eastern Europe	65.57	34.50	87.43	69.79
Communist Asia	31.75	26.29	96.64	50.40
Less developed countries	38.27	31.15	95.83	37.32
Middle America	81.53	79.65	93.74	75.27
East South America**	54.55	24.21	100.00	52.47
West South America	42.56	31.89	100.00	52.28
North Africa	51.41	48.34	100.00	68.14
West Africa	88.57	88.21	100.00	91.71
East Africa	83.61	81.13	100.00	91.51
West Asia	23.89	7.34	100.00	24.63
South Asia	21.82	21.93	69.82	17.93
East Asia-Pacific Islands ..	19.32	17.09	73.93	26.99
Southeast Asia	1.45	.55	1.00	5.15
World total	53.00	26.97	93.30	54.59
* Of which: U.K.	62.07	17.86	82.89	88.81
** Of which: Argentina	56.74	6.52	100.00	60.41

Note: U.S. figures do not include grain sorghum.

Source: Calculations based on appendix tables 6, 7, 9, and 10, and on sources in appendix table 11.

from 24 percent, with Southeast Asia using less than 2 percent of its grain disappearance in the form of coarse grain.

Table 68 completes the elements necessary for calculating grain consumption patterns that are broken down, first, among feed, food, and other uses, and second, between coarse grain and other grain (wheat and rice).

Future Grain Consumption

Grain Consumption Patterns

Assembling the estimations of grain use described earlier for food, livestock feed, industrial, and other uses, and applying relative share percentages for coarse grain provides estimated grain consumption patterns for a given year, on the assumption that the coarse grain shares continue to be valid into the future. Tables 69-74 present projected grain consumption patterns for 1962 and 1965 and several alternatives for 1980, which should be seen as trial balances of world grain demand derived from postulated developments in meat demand for meat and derived demand for feed grain (see also fig. 19).

Projected Feed Grain Consumption

Grain consumption by livestock is expected to reach 515 million tons in 1980, of which 301 million appears destined for use in the developed countries, 150 million in the central plan countries, and 65 million in the less developed countries; that is, 58, 29, and 13 percent, respectively. This world total is 58 percent higher than the 314 million tons estimated to have been fed to livestock in 1965, when 63, 28, and 9 percent, respectively, were accounted for by the developed, the central plan, and the less developed countries. These figures include grain sorghum.

These figures are presented as Case IV in table 75 and are based on the following assumptions:

- General assumptions underlying all the cases--
 1. Population and real income develop in the fashion underlying all the studies included in the present series, a fashion presented in tables 56 through 59.
 2. Income elasticities employed in per capita meat consumption are based on those set forth in table 58, which were derived from world cross-sectional meat-consumption data.
 3. Meat self-sufficiency rates remain as set forth in table 61. Discernable changes in world meat-trading patterns can be separately introduced into the present analysis and the consequences in feed grain consumption traced.
 4. Grain-meat input-output ratios remain as calculated in 1962, or as specified by cases, the ratios develop in accordance with the

Table 69.--World: Grain consumption pattern estimated for 1962, by region -- basic projection, constant grain-meat ratio

Region or country	All grains			Coarse grain			Wheat and rice		
	Food	Feed	Other	Food	Feed	Other	Food	Feed	Other
	----- 1,000 m.t. -----								
Developed countries	63,596	175,055	47,404	286,055	9,041	163,889	33,944	206,874	54,555
United States	12,319	92,441	16,304	121,064	2,111	91,369	13,730	107,210	10,208
Canada	1,233	9,792	3,073	14,098	108	8,503	1,752	10,363	1,125
European Community	17,894	39,135	12,909	69,938	1,857	33,750	8,902	44,509	16,037
EFTA*	8,044	21,129	6,809	35,982	1,866	18,739	5,841	26,446	6,178
Other Western Europe	6,068	7,165	2,256	15,489	247	7,012	1,276	8,535	5,821
Japan	14,163	3,096	4,317	21,576	878	2,670	1,363	4,911	13,285
South African Republic	2,772	925	683	4,380	1,895	911	517	3,323	877
Oceania.....	1,103	1,372	1,053	3,528	79	935	563	1,577	1,024
Central plan countries	175,362	76,882	51,528	303,772	47,104	70,522	26,879	144,505	128,258
Soviet Union	37,959	27,902	27,480	93,341	9,471	26,169	12,704	48,344	28,488
Eastern Europe	18,398	32,370	10,598	61,366	6,347	28,301	7,396	42,044	12,051
Communist Asia	119,005	16,610	13,450	149,065	31,286	16,052	6,779	54,117	87,719
Less developed countries	198,513	25,208	39,502	263,223	61,827	24,157	14,742	100,726	136,686
Middle America	9,242	3,401	3,191	15,834	7,361	3,188	2,402	12,951	1,881
East South America**	11,371	10,375	3,237	24,983	2,753	10,375	1,698	14,826	8,618
West South America	6,394	877	780	8,051	2,039	877	408	3,324	4,355
North Africa	10,120	1,393	1,761	13,274	4,892	1,393	1,200	7,485	5,228
West Africa	13,327	158	1,672	15,157	11,755	158	1,533	13,446	1,572
East Africa	10,365	507	2,902	13,774	8,409	507	2,656	11,572	1,956
West Asia	12,222	6,216	5,176	23,614	897	6,216	1,275	8,388	11,325
South Asia	85,098	1,332	16,068	102,498	18,662	930	2,881	22,473	66,436
East Asia-Pacific Islands	29,124	692	2,046	31,862	4,997	511	552	6,060	24,127
Southeast Asia	11,250	257	2,669	14,176	62	2	137	201	11,188
World total	437,471	277,145	138,434	853,050	117,972	258,568	75,565	452,105	319,499
* Of which: U.K.	4,351	11,290	3,680	6,571	777	9,358	3,268	13,403	3,574
**Of which: Argentina	1,945	2,886	1,740	19,321	127	2,886	1,051	4,064	1,818

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products.

Source: Tables 64, 66, 67, and 68.

Table 70.--World: Grain consumption pattern estimated for 1965, by region -- basic projection, constant grain-meat ratio

Region or country	All grains			Coarse grain			Wheat and rice					
	Food	Feed	Other	Food	Feed	Other	Food	Feed	Other	Total		
	----- 1,000 m.t. -----									Total		
Developed countries	63,432	194,746	50,642	308,820	9,078	182,347	37,258	228,683	54,354	12,399	13,384	80,137
United States	12,394	102,814	17,499	132,707	2,124	101,621	14,736	118,481	10,270	1,193	2,763	14,226
Canada	1,257	11,042	3,336	15,635	110	9,589	2,897	12,596	1,147	1,453	439	3,039
European Community	18,041	43,356	13,762	75,159	1,873	37,390	9,490	48,753	16,168	5,966	4,272	26,406
EFTA*	8,028	23,047	7,175	38,250	1,863	20,440	6,155	28,458	6,165	2,607	1,020	9,792
Other Western Europe	5,963	8,157	2,375	16,495	242	7,972	1,344	9,558	5,721	185	1,031	6,937
Japan	13,793	3,750	4,589	22,132	855	3,234	1,449	5,538	12,938	516	3,140	16,594
South African Republic	2,821	1,126	755	4,702	1,929	1,110	572	3,611	892	16	183	1,091
Oceania	1,135	1,454	1,151	3,740	82	991	615	1,688	1,053	463	536	2,052
Central plan countries	179,009	89,711	55,447	324,167	48,052	82,317	28,593	158,962	130,957	7,394	26,854	165,205
Soviet Union	38,187	32,927	29,465	100,579	9,528	30,882	13,327	53,737	28,659	2,045	16,138	46,842
Eastern Europe	18,299	37,359	11,200	66,858	6,313	32,663	7,816	46,792	11,986	4,696	3,384	20,066
Communist Asia	122,523	19,425	14,782	156,730	32,211	18,772	7,450	58,433	90,312	653	7,332	98,297
Less developed countries	206,768	29,777	43,904	280,449	64,586	28,512	17,480	110,578	142,182	1,265	26,424	169,871
Middle America	9,978	4,094	3,612	17,684	7,548	3,838	2,719	14,105	2,430	256	893	3,579
East South America**	12,148	11,689	3,614	27,451	2,941	11,689	1,896	16,526	9,207	0	1,718	10,925
West South America	3,501	1,025	874	5,400	1,116	1,025	457	2,598	2,385	0	417	2,802
North Africa	10,907	1,703	1,955	14,565	5,272	1,703	1,332	8,307	5,635	0	623	6,258
West Africa	14,383	197	1,858	16,438	12,687	197	1,704	14,588	1,696	0	154	1,850
East Africa	11,239	616	3,198	15,053	9,118	616	2,926	12,660	2,121	0	272	12,393
West Asia	13,041	7,682	5,774	26,497	957	7,682	1,422	10,061	12,084	0	4,352	16,436
South Asia	92,838	1,562	17,775	112,175	20,359	1,091	3,187	24,637	72,479	471	14,588	87,538
East Asia-Pacific Islands ..	26,453	904	2,278	29,635	4,521	668	1,684	6,873	21,932	236	594	22,762
Southeast Asia	12,280	305	2,966	15,551	67	3	153	223	12,213	302	2,813	15,328
World total	449,209	314,234	149,993	913,436	121,716	293,176	83,331	498,223	327,493	21,058	66,662	415,213
* Of which: U.K.	4,384	12,136	3,870	20,390	783	10,060	3,437	14,280	3,601	2,076	433	6,110
**Of which: Argentina	2,001	3,022	1,876	6,899	130	3,022	1,133	4,285	1,871	0	743	2,614

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products.

Source: Tables 64, 66, 67, and 68.

Table 71.--World: Grain consumption pattern estimated for 1980, by region, with linear meat elasticity and constant grain-meat ratio

Region or country	All grains			Coarse grain			Wheat and rice		
	Food	Feed	Other	Food	Feed	Other	Food	Feed	Other
	----- 1,000 m.t. -----								
Developed countries	57,911	277,003	69,821	404,735	9,379	259,541	50,111	319,031	48,532
United States	13,327	146,736	25,406	185,469	2,284	145,034	21,394	168,712	11,043
Canada	1,481	17,551	5,188	24,220	130	15,241	2,958	18,329	1,351
European Community	15,851	56,693	17,610	90,154	1,645	48,890	12,144	62,679	14,206
EFTA*	7,656	30,183	9,290	47,129	1,776	26,769	7,970	36,515	5,880
Other Western Europe	5,393	11,973	3,128	20,494	219	11,701	1,770	13,690	5,174
Japan	8,970	9,613	6,119	24,702	556	8,290	1,932	10,778	8,414
South African Republic	3,911	2,356	1,326	7,593	2,674	2,322	1,005	6,001	1,237
Oceania	1,322	1,898	1,754	4,974	95	1,294	938	2,327	144
Central plan countries	227,807	144,012	79,976	451,795	60,870	132,405	41,485	234,760	166,937
Soviet Union	39,380	53,577	41,538	134,495	9,825	50,250	19,203	79,278	29,555
Eastern Europe	18,358	56,911	15,002	90,271	6,334	49,757	10,470	66,561	12,024
Communist Asia	170,069	33,524	23,436	227,029	44,711	32,398	11,812	88,921	125,358
Less developed countries	305,489	53,549	74,679	433,717	96,207	51,090	28,090	175,387	209,282
Middle America	15,305	8,291	6,789	30,385	12,190	7,772	5,110	25,072	3,115
East South America**	14,024	17,082	5,243	36,349	3,395	17,082	2,751	23,228	10,629
West South America	5,101	1,872	1,555	8,528	1,627	1,872	813	4,312	3,474
North Africa	16,854	3,557	3,539	23,950	8,147	3,557	2,411	14,115	8,707
West Africa	21,099	402	3,194	24,695	18,611	402	2,929	21,942	2,488
East Africa	16,526	1,196	5,348	23,070	13,408	1,196	4,894	19,498	3,118
West Asia	18,878	15,725	10,109	44,712	1,386	15,725	2,490	19,601	17,492
South Asia	138,875	2,796	29,827	171,498	30,455	1,952	5,348	37,755	108,420
East Asia-Pacific Islands ..	40,294	2,064	4,018	46,376	6,886	1,526	1,084	9,496	33,408
Southeast Asia	18,533	564	5,057	24,154	102	6	260	368	18,431
World total	591,207	474,564	224,476	1,290,247	166,456	443,036	119,686	729,178	424,751
* Of which: U.K.	4,527	15,517	5,043	25,087	809	12,862	4,479	18,150	3,718
**Of which: Argentina	2,033	4,161	2,793	8,987	133	4,161	1,687	5,981	1,900

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products.

Source: Tables 64, 66, 67, and 68.

Table 72.--World: Grain consumption pattern estimated for 1980, by region, with linear meat elasticity and changing grain-meat ratio

Region or country	All grains			Coarse grain			Wheat and rice		
	Food	Feed	Other	Food	Feed	Other	Food	Feed	Other
	----- 1,000 m.t. -----								
Developed countries	57,911	285,416	69,821	413,148	9,379	267,157	50,111	326,647	48,532
United States	13,327	148,058	25,406	186,791	2,284	146,341	21,394	170,019	11,043
Canada	1,481	17,551	5,188	24,220	130	15,241	2,958	18,329	1,351
European Community	15,851	59,314	17,610	92,775	1,645	51,152	12,144	64,941	14,206
EFTA*	7,656	31,442	9,290	48,388	1,776	27,886	7,970	37,632	5,880
Other Western Europe	5,393	13,254	3,128	21,775	219	12,953	1,770	14,942	5,174
Japan	8,970	11,031	6,119	26,120	556	9,513	1,932	12,001	8,414
South African Republic	3,911	2,705	1,326	7,942	2,674	2,666	1,005	6,345	1,237
Oceania	1,322	2,061	1,754	5,137	95	1,405	938	2,438	1,227
Central plan countries	227,807	159,044	79,976	466,827	60,870	146,818	41,485	249,173	166,937
Soviet Union	39,380	57,575	41,538	138,493	9,825	54,000	19,203	83,028	29,555
Eastern Europe	18,358	56,911	15,002	90,271	6,334	49,757	10,470	66,561	12,024
Communist Asia	170,069	44,558	23,436	238,063	44,711	43,061	11,812	99,584	125,358
Less developed countries	305,489	70,766	74,679	450,934	96,207	66,390	28,090	190,687	209,282
Middle America	15,305	9,909	6,789	32,003	12,190	9,289	5,110	26,589	3,115
East South America**	14,024	22,280	5,243	41,547	3,395	22,280	2,751	28,426	10,629
West South America	5,101	2,264	1,555	8,920	1,627	2,264	813	4,704	3,474
North Africa	16,854	4,653	3,539	25,046	8,147	4,653	2,411	15,211	8,707
West Africa	21,099	603	3,194	24,896	18,611	603	2,929	22,143	2,488
East Africa	16,526	1,708	5,348	23,582	13,408	1,708	4,894	20,010	3,118
West Asia	18,878	18,798	10,109	47,785	1,386	18,798	2,490	22,674	17,492
South Asia	138,875	5,592	29,827	174,294	30,455	3,904	5,348	39,707	108,420
East Asia-Pacific Islands ..	40,294	3,895	4,018	48,207	6,886	2,880	1,084	10,850	33,408
Southeast Asia	18,533	1,064	5,057	24,654	102	11	260	373	18,431
World total	591,207	515,226	224,476	1,330,909	166,456	480,365	119,686	766,507	424,751
* Of which: U.K.	4,527	16,184	5,043	25,754	809	13,415	4,479	18,703	3,718
**Of which: Argentina	2,033	5,972	2,793	10,798	133	5,972	1,687	7,792	1,900

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products.

Source: Tables 64, 66, 67, and 68.

Table 73.--World: Grain consumption pattern estimated for 1980, by region, with constant meat elasticity, and constant grain-meat ratio 1/

Region or country	All grains			Coarse grain			Wheat and rice					
	Food	Feed	Other	Total	Food	Feed	Other	Total	Food	Feed	Other	Total
Developed countries.....	57,911	281,741	69,821	409,473	9,379	261,847	50,111	321,337	48,532	19,894	19,710	88,136
	----- 1,000 m.t. -----											
United States	13,327	130,053	25,406	168,786	2,284	128,544	21,394	152,694	11,043	1,509	4,012	16,564
Canada	1,481	18,190	5,188	24,859	130	15,796	2,958	18,884	1,351	2,394	2,230	5,975
European Community	15,851	71,202	17,610	104,663	1,645	61,405	12,144	75,194	14,206	9,797	5,466	29,469
EFTA*.....	7,656	34,314	9,290	51,260	1,776	30,433	7,970	40,179	5,880	3,881	1,320	11,081
Other Western Europe	5,393	14,477	3,128	22,998	219	14,119	1,770	16,108	5,174	358	1,358	6,890
Japan	8,970	9,613	6,119	24,702	556	8,290	1,932	10,778	8,414	1,323	4,187	13,924
South African Republic ...	3,911	1,999	1,326	7,236	2,674	1,970	1,005	5,649	1,237	29	321	1,587
Oceania	1,322	1,893	1,754	4,969	95	1,290	938	2,323	1,227	603	816	2,646
Central plan countries	227,807	162,131	79,976	469,914	60,870	148,978	41,485	251,333	166,937	13,153	38,491	218,581
Soviet Union	39,380	61,781	41,538	142,699	9,825	57,944	19,203	86,972	29,555	3,837	22,335	55,724
Eastern Europe	18,358	64,542	15,002	97,902	6,334	56,429	10,470	73,233	12,024	8,113	4,532	24,669
Communist Asia	170,069	35,808	23,436	229,313	44,711	34,605	11,812	91,128	125,358	1,203	11,624	138,185
Less developed countries ...	305,489	49,808	74,679	429,976	96,207	47,395	28,090	171,692	209,282	2,413	46,589	258,284
Middle America	15,305	8,223	6,789	30,317	12,190	7,708	5,110	25,008	3,115	515	1,679	5,309
East South America **	14,024	14,829	5,243	34,096	3,395	14,829	2,751	20,975	10,629	0	2,492	13,121
West South America	5,101	1,872	1,555	8,528	1,627	1,872	813	4,312	3,474	0	742	4,216
North Africa	16,854	3,306	3,539	23,699	8,147	3,306	2,411	13,864	8,707	0	1,128	9,835
West Africa	21,099	364	3,194	24,657	18,671	364	2,929	21,904	2,488	0	265	2,753
East Africa	16,526	1,143	5,348	23,017	13,408	1,143	4,894	19,445	3,118	0	454	3,572
West Asia	18,878	14,877	10,109	43,864	1,386	14,877	2,490	18,753	17,492	0	7,619	25,111
South Asia	138,875	2,889	29,827	171,591	30,455	2,017	5,348	37,820	108,420	872	24,479	133,771
East Asia-Pacific Islands	40,294	1,722	4,018	46,034	6,886	1,273	1,084	9,243	33,408	449	2,934	136,791
Southeast Asia	18,533	583	5,057	24,173	102	6	260	368	18,431	577	4,797	23,805
World total	591,209	493,680	224,476	1,309,363	166,456	458,220	119,686	744,362	424,751	35,460	104,790	565,001
* Of which: U.K.	4,527	17,061	5,043	26,631	809	14,142	4,479	19,430	3,718	2,919	564	7,201
**Of which: Argentina ...	2,033	3,432	2,793	8,258	133	3,432	1,687	5,252	1,900	0	1,106	3,006

1/ U.S. per capita meat consumption held to Argentina and Australian levels.

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products.

Source: Tables 64, 66, 67, and 68.

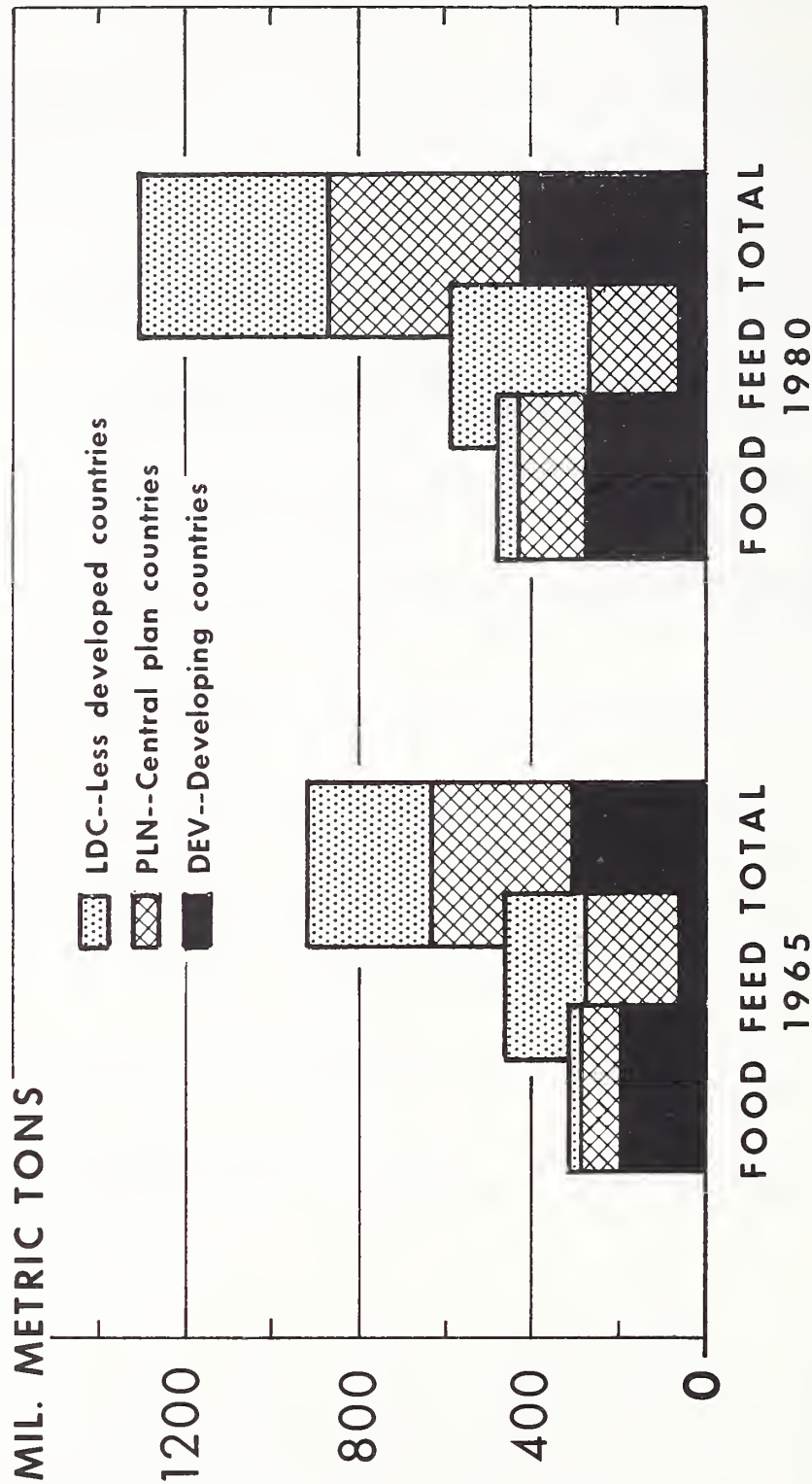
Table 74.--World: Grain consumption pattern estimated for 1980, by region, with constant meat elasticity and changing grain-meat ratio 1/

Region or country	All grains			Total	Coarse grain			Total	Wheat and rice			Total
	Food	Feed	Other		Food	Feed	Other		Food	Feed	Other	
	----- 1,000 m.t. -----											
Developed countries	57,911	291,069	69,821	418,801	9,379	270,287	50,111	329,777	48,532	20,782	19,710	89,024
United States	13,327	131,225	25,406	169,958	2,284	129,703	21,394	153,381	11,043	1,522	4,012	16,577
Canada	1,481	18,190	5,188	24,859	130	15,796	2,958	18,884	1,351	2,394	2,230	5,975
European Community	15,851	74,493	17,610	107,954	1,645	64,243	12,144	78,032	14,206	10,250	5,466	29,922
EFTA*	7,656	35,743	9,290	52,689	1,776	31,700	7,970	41,446	5,880	4,043	1,320	11,243
Other Western Europe	5,393	16,026	3,128	24,547	219	15,662	1,770	17,651	5,174	364	1,358	6,896
Japan	8,970	11,031	6,119	26,120	556	9,513	1,932	12,001	8,414	1,518	4,187	14,119
South African Republic	3,911	2,296	1,326	7,533	2,674	2,262	1,005	5,941	1,237	34	321	1,592
Oceania	1,322	2,065	1,754	5,141	95	1,408	938	2,441	1,227	657	1,816	2,700
Central plan countries	227,807	178,525	79,976	486,308	60,870	164,690	41,485	267,045	166,937	13,835	38,491	21,926
Soviet Union	39,380	66,391	41,538	147,309	9,825	62,268	19,203	91,296	29,555	4,123	22,335	56,013
Eastern Europe	18,358	64,542	15,002	97,902	6,334	56,429	10,470	73,233	12,024	8,113	4,532	24,669
Communist Asia	170,069	47,592	23,436	241,097	44,771	45,993	11,812	102,576	125,358	1,599	11,624	138,581
Less developed countries	305,489	65,849	74,679	446,017	96,207	61,553	28,090	185,850	209,282	4,296	46,589	260,167
Middle America	15,305	9,828	6,789	31,922	12,190	9,213	5,110	26,513	3,115	615	1,679	5,409
East South America**	14,024	19,343	5,243	38,610	3,395	19,343	2,751	25,489	10,629	0	2,492	13,121
West South America	5,101	2,264	1,555	8,920	1,627	2,264	813	4,704	3,474	0	742	4,216
North Africa	16,854	4,324	3,539	24,717	8,147	4,324	2,411	14,882	8,707	0	1,128	9,835
West Africa	21,099	546	3,194	24,839	18,611	546	2,929	22,086	2,488	0	265	2,753
East Africa	16,526	1,633	5,348	23,507	13,408	1,633	4,894	19,935	3,118	0	454	3,572
West Asia	18,878	17,784	10,109	46,771	1,386	17,784	2,490	21,660	17,492	0	7,619	25,111
South Asia	138,875	5,777	29,827	174,479	30,455	4,034	5,348	39,837	108,420	1,743	24,479	134,642
East Asia-Pacific Islands ..	40,294	3,249	4,018	47,561	6,886	2,402	1,084	10,372	33,408	847	2,934	37,189
Southeast Asia	18,533	1,101	5,057	24,691	102	10	260	372	18,431	1,091	4,797	24,319
World total	591,207	535,443	224,476	1,351,126	166,456	496,530	119,686	782,672	424,751	38,913	104,790	568,454
* Of which: U.K.	4,527	17,795	5,043	27,365	809	14,750	4,479	20,038	3,718	3,045	564	7,327
**Of which: Argentina	2,033	4,426	2,793	9,252	133	4,426	1,687	6,246	1,900	0	1,106	3,006

1/ U.S. per capita meat consumption held to Argentina and Australian levels.

Note: U.S. figures do not include grain sorghum. "Other" uses of grain include wet-process products. Source: Tables 64, 66, 67, and 68.

WORLD: GRAIN CONSUMPTION, BASIC PROJECTION TO 1980



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Figure 19

Table 75.--World: Grain consumption by livestock, by region, projections for 1980, based on alternative sets of assumptions

Region or country	Case						
	I	II	III	IV	V	VI	VII
	----- Mil. m.t. -----						
Developed countries	251.2	257.7	297.0	301.3	305.4	336.7	346.3
United States	146.7	147.9	166.7	167.5	168.1	185.0	186.5
Canada	14.7	14.7	17.6	17.6	17.6	18.2	18.2
European Community	47.4	49.6	56.7	58.0	59.3	71.2	74.5
EFTA*	25.5	26.5	30.2	30.8	31.4	34.3	35.7
Other Western Europe	9.2	10.2	12.0	12.6	13.3	14.5	16.1
Japan	4.3	4.9	9.6	10.3	11.0	9.6	11.0
South African Republic	1.7	1.9	2.4	2.5	2.7	2.0	2.3
Oceania	1.9	2.1	1.9	2.0	2.1	1.9	2.1
Central plan countries	108.5	120.1	144.0	149.2	159.0	162.0	178.7
Soviet Union	39.6	42.6	53.6	55.6	57.6	61.8	66.4
Eastern Europe	42.5	42.5	56.9	56.9	56.9	64.5	64.5
Communist Asia	26.4	35.1	33.5	36.7	44.6	35.9	47.7
Less developed countries	42.2	55.7	58.7	64.6	77.1	56.2	73.6
Middle America	6.6	7.9	8.3	8.7	9.9	8.2	9.8
East South America**	14.7	19.2	22.3	25.2	28.6	22.3	28.6
West South America	1.6	1.9	1.9	2.0	2.3	1.9	2.3
North Africa	2.6	3.4	3.6	3.6	4.7	3.3	4.3
West Africa .....	.3	.4	.4	.4	.6	.6	.9
East Africa .....	.9	1.3	1.2	1.4	1.7	1.1	1.5
West Asia	11.5	13.7	15.7	17.3	18.8	13.8	16.5
South Asia	2.2	4.5	2.8	3.4	5.6	2.7	5.4
East Asia-Pacific Islands	1.4	2.6	2.1	2.0	3.9	1.7	3.2
Southeast Asia .....	.4	.8	.6	.6	1.1	.5	1.0
World total	401.9	433.4	499.8	515.1	541.5	555.1	598.6
* Of which: U.K.	13.5	14.1	15.5	15.9	16.2	17.0	17.8
**Of which: Argentina	3.9	5.6	4.2	5.1	6.0	3.8	5.5

See notes at end of table.

Continued--

Table 75.--World: Grain consumption by livestock, by region, projections for 1980, based on alternative sets of assumptions -- continued

Assumptions:

General:

- (1) Population and real income develop as in tables 56 to 59.
- (2) Income elasticities of demand for meat are based on those in table 47.
- (3) Meat self-sufficiency rates remain as in table 61.
- (4) Grain-meat ratios develop as in table 63.
- (5) Percentage distributions of livestock products remain as in table 49.
- (6) Meat-grain price ratios remain unchanged through the projection period.

Case I Constant MPC, SSM, and RGM.

II Constant MPC and SSM; changing RGM.

III Linear MPC; constant SSM; constant RGM; repressed US-MPC; constant elasticity JAP-MPC; basically table 71.

IV Linear MPC; constant SSM; lagging RGM; repressed US-MPC; constant elasticity JAP-MPC.

V Linear MPC; constant SSM; changing RGM; repressed US-MPC; constant elasticity JAP-MPC; basically table 72.

VI Computed elasticity MPC; constant SSM and RGM; basically table 73.

VII Computed elasticity MPC; constant SSM; changing RGM; basically table 74.

Note: Figures for the United States, West South America, and West Asia are adjusted. The U.S. figures include grain sorghum.

Source: Computations similar to those underlying tables 71-74.

functional relationship underlying table 63.

5. The percentage distribution of livestock products within a given region remains, through the projection period, as it was computed for table 49. The tendency for given livestock products to expand more rapidly than others will have a calculable effect on the grain-meat ratio. According to functions explained in the text, milk and poultry will increase the grain-meat ratio and beef will decrease it.
 6. Meat-grain price ratios remain unchanged through the projection period within each region. Since the projections are developed from cross-sectional data, and the meat-grain price ratio entered into the regression functions, the effect of this price ratio has been theoretically accounted for and removed. The human demand for meat and for grain were both found sensitive to this ratio.
 7. Grain consumption can be projected independently from grain production.
- Special assumptions peculiar to Case IV --
 1. Per capita meat consumption, by region, is computed with equations of constant slope that have elasticities in the projection base, which are determined by adjusted computations. However, U.S. meat consumption was constrained not to exceed the maximums for the world, found in Oceania and Argentina (110 kilograms per capita), which, in turn, were held constant; and meat consumption in the EEC and Japan was allowed to develop at higher-than-computed rates.
 2. Self-sufficiency rates for meat are constant through the projection period.
 3. The grain-meat ratio is allowed to change but with a delayed effect; thus, by 1980, grain-meat ratios as calculated for, say 1973 or 1974, would be in effect.

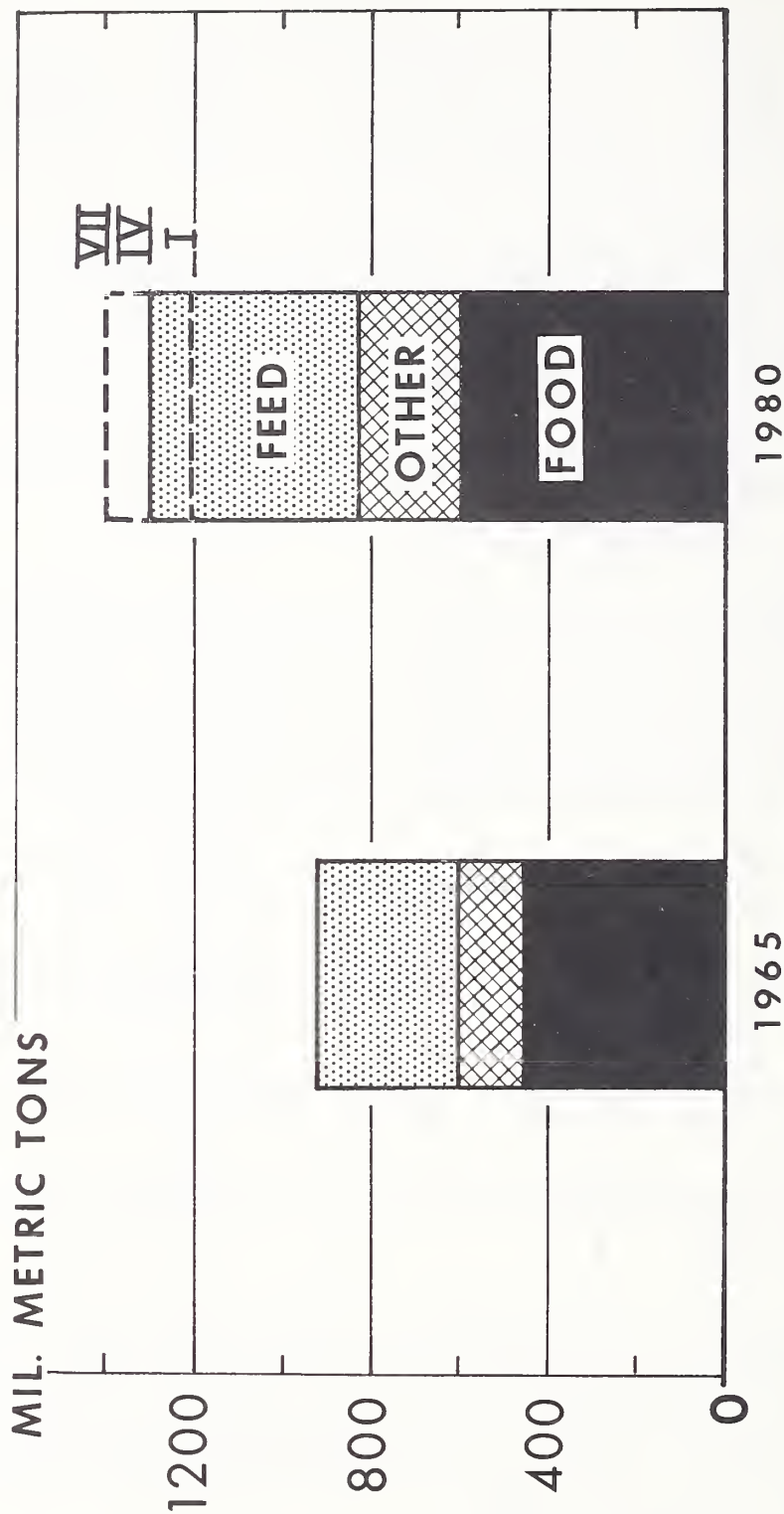
If these assumptions materialize, the projections described here under Case IV may be expected to take shape (see fig. 20).

The other cases represent plausible sets of hypotheses from which comparisons with emerging reality can be made, as local circumstances in the regions of the world determine.

Cases I and II (table 75) are based on the assumption of constant per capita meat consumption and no change in meat self-sufficiency. The differences between the cases are entirely attributable to change or constancy of the grain-meat ratio. No income effect enters into the evolution of meat consumption. At the world level, the projection based on an assumption of change in the grain-meat ratios is 8 percent higher than the constant ratio projection. This differential holds in the other cases.

Cases III and V (table 75) are of a kind with Case IV, the only differences being found in the degree of change permitted in the grain-meat ratios. In

WORLD: GRAIN CONSUMPTION, PROJECTION VARIATIONS TO 1980



NOTE: I, IV, AND VII ARE ALTERNATIVE PROJECTIONS; SEE TABLE 75 AND TEXT.

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Figure 20

Case III, they are constant through time. In Case V, they are fully changing. As explained above, in Case IV, they are sluggishly changing.

Cases VI and VII (table 75) contrast with the above sets, in that they allow freer rise in the projections, with some restrictions on U.S. and Japanese meat consumption relaxed.

Two conclusions emerge at once from a comparison of the projections. In the developed countries, the assumption as to slope or elasticity of the meat-demand function is the most sensitive variable. In the less developed countries, the critical variable is the grain-meat input-output ratio. Feed grain consumption in the developed countries varies from Case III to Case V between 297 million and 305 million tons in 1980, a difference of only 3 percent. A comparison of the projections obtained for the developing countries gives 58 million and 77 million tons, a difference of over 30 percent. For the world as a whole, these cases give 500 million and 542 million tons and differ by 9 percent.

The magnitude of the development effort by the less developed countries, which is implied by the underlying income and population figures, is brought out through comparison of the change in grain feeding with that projected for the developed countries. Overall growth in grain feeding in the developed countries as a whole is 45 percent, referring to Case IV. But in the group of less developed countries, it is over 115 percent, more than doubling in 15 years. However, even if per capita meat consumption should remain constant in the less developed countries during this period, population growth alone, allowing for no change in grain-feeding practices, would cause grain consumption by livestock to grow by over 40 percent; this growth is nearly at the rate of increase in the developed countries while they improve their practices.

Another projection that can be called Case VIII would appear to be a quite plausible outcome of development circumstances. In the extreme low ranges of per capita income, where not enough is known about the relationship between income and livestock and grain production, it seems probable that the real-income projections underlying all the studies in the series presuppose a favorable opportunity for meat demand to expand as projected in Case IV. If this should prove not to be the case among the less developed countries, per capita demand for meat may not be permitted to grow. The synthetic case envisioned, Case VIII, is a combination of Case IV for the developed countries and Case I for the group of less developed countries. This projection would lead to a world total for feed grain consumption of about 485 million tons, if Communist Asia evolves as the less developed countries in Case I and if the other central plan countries grow with the developed countries as in Case IV. A comparison of these lines of development leads to the following conclusions:

- An allocation of 22 million tons of feed grain to the less developed countries would enable their livestock economies to stay in the main sequence of development. A 30 million-ton allocation would attend to the basic needs of the less developed countries and of the countries of Communist Asia as well.

Implications for World Grain Consumption and Trade

As with grain fed to livestock, the assumptions underlying the estimation of human consumption, industrial, and other uses of grain are subject to adjustment. Each such adjustment creates numerous additional estimates to recombine into a set of coherent projections of total grain consumption. Since the study reported on here concentrates on the analysis of feed grain, one standard variant is employed in estimating food use and industrial and other use. Likewise, to deduce implications of the analysis of feed grain demand for future international grain trade, one standard projection of grain production is employed below. Various consumption estimates are ranged beside this projection and the differences are treated as net-trade flows. These arrangements are made to simplify the analysis, while exploring the implications of demand factors. In fact, the analysis oversimplifies, for many other factors contribute to explaining the resulting differences. It is highly likely that in large parts of the real world, production and consumption are not independent but predetermine each other in mutually recursive fashion. Nor is the great, partly unused productive capacity of the United States and other more developed regions adequately accounted for. Any and all other problems with projection formulas and techniques, or in the establishment of the base quantities from which changes are measured, would also tend to produce discrepancies and enhance these differences.

If it is assumed that consumption of grain as food and industrial and other uses of grain will develop as projected earlier, total consumption of grain may be expected to reach about 1,330 million tons in 1980, under the Case IV assumption as to feed grain, a figure that is about 43 percent higher than world grain consumption in 1965. Under the different assumptions described above, the variation in grain feeding might cause the increase in world grain consumption to range from 31 to 53 percent, in terms of the cases discussed above. In the developed countries, a rise of 32 percent is anticipated. Rises of 41 percent in the central plan countries and 58 percent in the less developed countries appear likely.

Coarse grain consumption will probably grow more rapidly than total grain consumption, and is expected to reach 761 million tons in 1980, 49 percent higher than in 1965. Increases by 41 percent are considered likely in the developed countries, 49 percent in the central plan countries, and 64 percent in the less developed countries.

These projected grain consumption estimates are shown in table 76 for all grain and table 77 for coarse grain. Case IV and the range from Cases I to VII are given in these tables.

In the foregoing sections, projections of grain consumption for each of the regions were made under several alternative assumptions. Implicit in these projections was the fact that the consumption levels in any country fitted into a main sequence of consumption patterns as this nation moved up the scale of economic development. Thus, a set of consistent consumption estimates existed within this "normal" sequential pattern. If the thesis is accepted that a country's final equilibrium position tends toward this "normal" pattern, then it is feasible to aggregate separate consumption levels for each alternative

Table 76.--World: Estimated grain consumption, computer reconciliation with production, and implied net trade in grain, 1980, by region

Region or country	Estimated consumption:				Computer		Implied net trade:	
	All grain		reconciliation :		reconciliation :		All grain	
	Case I: Case IV	Case VII: Case IV	Production :	Consumption :	Production :	Consumption :	Case I: Case IV	Case VII
	378.9	429.1	474.0	482.8	440.3	42.5	103.9	53.7
Developed countries	206.8	230.5	250.1	294.5	225.2	69.3	87.7	64.0
North America	80.9	91.5	108.0	86.6	93.6	-7.0	5.7	-4.9
European Community	42.4	47.7	52.6					-21.4
EEFTA*	17.7	21.1	24.6	59.1	69.7	-10.6	1.0	-9.7
Other Western Europe	19.4	25.4	26.1	12.9	36.4	-23.5	-6.5	-12.5
Japan	6.9	7.7	7.5	12.0	9.0	3.0	5.1	4.3
South African Republic	5.0	5.1	5.2	17.7	6.4	11.3	12.7	12.6
Oceania	416.3	457.0	486.5	437.8	439.4	-1.6	21.5	-19.2
Central plan countries	120.5	136.5	147.3	163.5	158.4	5.1	43.0	27.0
Soviet Union	75.9	90.3	97.9	86.3	87.4	-1.1	10.4	-4.0
Eastern Europe	219.9	230.2	241.2	188.0	193.6	-5.6	-31.9	-42.2
Communist Asia	422.3	444.7	453.7	390.6	426.4	-35.8	-31.7	-54.1
Less developed countries	28.7	30.8	31.9	22.5	27.5	-5.0	-6.2	-8.3
Middle America	33.9	44.4	47.8	52.2	43.7	8.5	18.3	7.8
East South America**	8.2	8.6	8.9	6.6	11.2	-4.6	-1.6	-2.0
West South America	23.0	24.0	24.7	18.7	28.1	-9.4	-4.3	-5.3
North Africa	25.6	24.7	25.2	15.9	21.0	-5.1	-6.9	-8.8
West Africa	22.8	23.3	23.4	22.3	22.2	.1	-5	-1.0
East Africa	40.5	46.3	45.5	30.4	38.8	-8.4	-10.1	-15.9
West Asia	170.9	172.1	174.1	151.4	157.3	-5.9	-19.5	-20.7
South Asia	45.7	46.3	47.5	41.7	51.3	-9.6	-4.0	-4.6
East Asia-Pacific Islands ..	24.0	24.2	24.6	28.9	25.3	3.6	4.9	4.7
Southeast Asia	1,217.5	1,330.7	1,414.2	1,311.2	1,306.1	5.1	93.7	-19.5
World total	23.1	25.5	27.4	19.0	25.3	-6.3	-4.1	-6.5
* Of which: U.K.	8.7	9.9	10.3	23.5	11.3	12.2	14.8	13.6
**Of which: Argentina								13.2

Table 77.--World: Estimated coarse grain consumption, computer reconciliation with production, and implied net trade in grain, 1980, by region

Region or country	Estimated consumption:			Computer reconciliation:			Implied net trade:		
	Coarse grain			reconciliation:			Coarse grain		
	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:	Case I: Case IV: Case VII:
	Prod-: tion :	Prod-: tion :	Prod-: tion :	Consum-: tion :	Consum-: tion :	Computer: tion :	Computer: Case I: Case IV: Case VII:	Computer: Case I: Case IV: Case VII:	Computer: Case I: Case IV: Case VII:
	----- Mil. m.t. -----								
Developed countries	303.9	342.1	377.6	340.4	335.7	4.7	36.5	-1.7	-37.2
North America	186.7	207.8	225.6	229.4	197.1	32.3	42.7	21.6	3.8
European Community	56.2	63.6	75.1	50.1	60.8	-10.7	-6.1	-13.5	-25.0
EFTA*	32.9	37.0	40.8	42.6	49.5	-6.9	-2.1	-8.5	-14.6
Other Western Europe	11.8	14.1	16.4						
Japan	8.5	11.1	11.4	1.0	17.7	-16.7	-7.5	-10.1	-10.4
South African Republic	5.5	6.1	5.9	11.0	7.1	3.9	5.5	4.9	5.1
Oceania	2.3	2.4	2.4	6.3	3.5	2.8	4.0	3.9	3.9
Central plan countries	213.1	237.2	253.6	200.0	198.4	1.6	-13.1	-37.2	53.6
Soviet Union	71.0	80.4	86.8	78.0	77.2	.8	7.0	-2.4	-8.8
Eastern Europe	55.9	66.6	72.2	55.5	54.4	1.1	-.4	-11.1	-16.7
Communist Asia	86.2	90.2	94.6	66.5	66.8	-.2	-19.7	-23.7	-28.1
Less developed countries	170.3	181.9	186.3	163.3	169.0	5.7	-7.0	-18.6	-23.0
Middle America	23.7	25.4	26.3	18.0	20.2	2.2	-5.7	-7.4	-8.3
East South America**	21.7	28.4	30.5	33.5	25.5	8.0	11.8	5.1	3.0
West South America	4.2	4.3	4.5	3.2	4.4	-1.2	-1.0	-1.1	-1.3
North Africa	13.5	14.1	14.5	11.1	12.1	-1.0	-2.4	-3.0	-3.4
West Africa	22.8	21.9	22.4	14.0	16.8	-2.8	-8.8	-7.9	-8.4
East Africa	19.3	19.7	19.8	20.0	18.8	1.2	-.7	.3	-.2
West Asia	17.7	20.3	19.9	11.0	13.8	-2.8	-6.7	-9.3	-8.9
South Asia	37.6	37.9	38.3	37.0	39.8	-2.8	-.6	-.9	-1.3
East Asia-Pacific Islands	9.4	9.5	9.7	12.0	15.7	-3.7	2.6	2.5	2.3
Southeast Asia .....	.4	.4	.4	3.5	1.9	-1.6	-3.1	-3.1	-3.1
World total	687.3	761.2	817.5	703.7	702.8	.9	16.4	-57.5	-113.8
* Of which: U.K.	16.7	18.4	19.8	14.5	16.3	1.8	-2.2	-3.9	-5.3
**Of which: Argentina	5.8	6.6	6.9	13.4	6.4	7.0	7.6	6.8	6.5

to a world total. However, in the real world, aberrations from the main sequence of events occur. For this reason, several additional variants in consumption by livestock were shown to extend the range of possibilities (table 75).

Consumption levels in these demand variants could be further influenced by factors other than demand that were excluded from the analysis. In particular, consumption levels did not account for the interaction between production and demand within countries, regions, and the world. Thus, the impacts of prices and trade on demand and of demand on prices and trade were excluded. To include them would have required (1) incorporating technical and demand functions generated in this report under each alternative into a world grain model, along with a corresponding set of production functions and policy and trade constraints, and then (2) observing the effect of varying demand levels on production, trade, and prices. We did not do this. Our interest here was to obtain an independent set of demand estimates.

For analysis of implications of these consumption projections for international trade, the projections were compared with grain production projections for 1980 that were developed in another report in the series. A computer model of world grain trade has been created that simultaneously determines prices, production, consumption, and trade under specific assumptions as to demand and supply elasticities, trend factors, policy, trade, and other constraints. From several computed production projections, the one chosen for comparison with these demand projections developed here was based on (1) continuation of present programs and policies and (2) continuing adjustment by major exporters of their supplies to maintain world prices at reasonable levels.

In making trade inferences from data in tables 76 and 77, one should note that each demand variant would generate its own production and price levels in a real world situation. This action by demand variants would tend to reduce supply-demand gaps suggested by the tables. Also, trade policies of many countries discourage import trade at those levels.

The balance between the projection of grain production -- contained in the columns of tables 76 and 77 show that the computer reconciliation between production and consumption -- and grain consumption calculated in Case IV must be considered quite satisfactory. The difference is less than 2 percent at the world level, which is not large for this kind of estimation. Perfect agreement is, in any event, obtainable within the context of the estimates of Cases I and IV. One or a combination of three adjustments will produce such agreement: (1) a slight downward displacement of Case IV estimates of grain consumption in developing countries toward those of Case I (constant per capita meat consumption); (2) a similar downward displacement of estimated grain consumption in Communist Asia; or (3) the realization of slightly higher levels of grain production than the projections present. Continuation of some restraint on expansion of meat consumption in less developed regions, combined with general encouragement of world grain production and relaxation of production controls in some developed areas, would very likely affect this balance without necessarily producing a rise in grain prices. For these reasons, differences at regional levels between computer-calculated net balances and those implied by using, say, Case IV, are not considered of great significance. Differences discerned by comparison of one case with another are of greater importance.

Scrutiny of grain consumption estimates by cases and comparison with results of the computer model suggest that the various cases are plausible. The interplay of social and economic factors around the world may bring about one or another of the special situations as the regions are considered individually. Feed grain consumption in less developed countries is highly responsive to changes in livestock technology, a situation that is reflected in the feed rates underlying the grain-meat ratio, and these relationships are linked, in turn, with the development of per capita income. These relationships suggest that cases representing higher feed grain consumption in the less developed countries may well materialize, in which event demand for feed grain in the developing world may prove to be stronger, and flow of grain through international trade correspondingly higher than is customarily supposed.

The largest free world international market for coarse grain is likely to continue to be Western Europe, with the EEC importing about 13 million tons in 1980 and the rest of Western Europe taking over 8 million. At these levels, the EEC market will grow but little, while imports to the rest of Europe will have risen by 60 percent since 1965. But potential for rapid expansion is there, and a more rapid, but still highly plausible, expansion of EEC meat consumption could easily expand EEC grain imports by an additional 15 million tons, of which 12 million would be coarse grain. For similar reasons, the rest of Western Europe might very well import a further 7 million tons. Overcoming consumer resistance to affluence and official reluctance to change seem to be the principal barriers to these developments.

With Japan, the situation is different. Meat consumption has been so low and income has grown so rapidly that forecasters are being surprised. A doubling of coarse grain imports to 10 million tons is expected from 1965-80, at an income elasticity of demand for meat of .70, but unit elasticity may be more plausible in this case, which would lead to imports of 13 million tons. Even higher coarse grain imports are expected by some, in which event Japan may displace the EEC as largest importer.

The market for coarse grain in the less developed countries as a group is smaller than that for the EEC but appears headed into more dynamic growth. From a net-export position of 5 million tons in 1965, these areas are expected to become net importers of 7 million tons in 1980, if present levels of per capita meat consumption are not to be sacrificed. If expected increases in incomes are born out, net imports may reach 18 million tons. To be sure, these imports are imbedded in net imports of all grains of 37 million and 60 million tons, respectively, in 1980.

Three regions are each likely to require about 7 million tons of coarse grain in 1980, Mexico-Central America, West Africa, and West Asia. Three less developed regions will contribute net exports: East South America (containing Argentina), upwards of 5 million tons; East Asia-Pacific Islands and Southeast Asia, about 3 million each. The other regions will contribute lesser amounts to the net trade balance.

Among the central plan regions, one is impressed with the massive imports that may be required by Eastern Europe and Communist Asia, if meat consumption

levels are to be maintained.

Among the developed exporting regions, South Africa and Oceania are each expected to contribute 4 million or 5 million tons of coarse grain in 1980, up from less than a million for each region in 1965. Canada's exports should hold at about 1 million tons.

In 1965, Australia, New Zealand, and Argentina were consuming livestock products at levels that could be regarded as saturated, and more income cannot be expected to entice consumption higher. During the projection period, the United States is also expected to reach saturation levels of meat consumption. But in other countries, more income is expected to lift meat consumption to increasing heights. In the EEC, Japan, and Spain, meat demand is soaring. In Latin America, West Asia, and the Near East, it is on the move. Elsewhere, meat demand will likely grow at the earliest opportunity. All such rises imply an accompanying rise in feed grain consumption.

Other commodities, such as root crops, grass, oilseed, and meal, are also livestock feed. As substitutes, they pose latent threats to the continued rise of feed grain consumption. However, except in the EEC and Japan, highly technological substitution of other substances does not seem about to occur because these substances are complementary at the rates at which such feeds are customarily used. And even in the EEC and Japan, the substitution is limited.

Although the United States is expected to continue to lead the world in exports of feed grains, the experience of the 1960's demonstrated that less developed countries, if they are efficient producers, can share in the future growth of the market. Of nine countries that accounted for 80 to 88 percent of this trade, four were less developed countries.

Some of the other implications of the study reported on here are quite far-reaching for the less developed countries. Evaluation of the world market for feed grain found it to be the dynamic part of the world market for grains in general and to be situated, in terms of absolute growth, in the developed countries. The less developed countries can reasonably look forward to participating in the further development of this market. However, the market for feed grain within the developing regions is also likely to become increasingly dynamic, as the processes of economic development proceed. Any appreciable increases in real per capita income of the less developed countries are likely to become transformed into substantial increases in the demand for feed grain. Thus, it appears that if countries that hope to export are not able to find markets for sales to the developed countries, they may well be able to develop their own internal markets for feed grain and thereby reduce or forestall tendencies toward rising dependence on imported feed grain. For the less developed countries as a group, the potential demand for meat is so strong that local supplies of feed grain either already are, or are likely to become, strained. Efficient producers among the less developed countries, then, can reasonably expect to be able to obtain or expand markets in the developed countries, to open or expand markets among other less developed countries, or finally, to use expanded feed grain production to help satisfy growing domestic demand for feed grain.

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APPENDIXES

REGIONAL COMPOSITION OF THE WORLD GRAIN-LIVESTOCK ECONOMY

<u>Symbol</u>	<u>Country or Region</u>
DEV	DEVELOPED COUNTRIES
USA	United States
CAN	Canada
EEC	European Economic Community: Belgium, Luxembourg, Netherlands, France, West Germany, and Italy
EFTA	European Free Trade Association:* Austria, Denmark, Finland, Norway, Portugal, Sweden, Switzerland, and the United Kingdom
OWE	Other Western Europe: Greece, Iceland, Ireland, Malta, and Spain
JAP	Japan
SAF	South African Republic
OCN	Oceania: Australia and New Zealand
PLN	CENTRAL PLAN COUNTRIES
USSR	Soviet Union
EE	Eastern Europe: Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and Yugoslavia
CHN	Communist Asia: China (Mainland), Mongolia, North Korea, and North Vietnam
LDC	LESS DEVELOPED COUNTRIES
CA	Middle America: Costa Rica, El Salvador, Guatemala, Honduras, British Honduras, Mexico, Nicaragua, Panama, and the Caribbean including Cuba
ESA	East South America:* Argentina, Brazil, Guyana, French Guiana, Paraguay, Surinam, Uruguay, and Venezuela
WSA	West South America: Bolivia, Chile, Colombia, Ecuador, and Peru

* Note: see footnote at end of list.

APPENDIXES -- Continued

Symbol

Country or Region

LESS DEVELOPED COUNTRIES--Continued

NAF	North Africa: Algeria, United Arab Republic, Libya, Morocco, The Sudan, and Tunisia
WAF	West Africa: Angola, Cameroon, Central African Republic, Chad, Congo (Kinshasa), Congo (Brazzaville), Dahomey, Gabon, Gambia, Ghana, Guinea, Ivory Coast, Liberia, Mali, Mauretania, Niger, Nigeria, Portuguese Guinea, Senegal, Sierra Leone, Togo, Upper Volta, and Other Portuguese West Africa
EAF	East Africa: Botswana, Burundi, Ethiopia, Kenya, Lesotho, Malagasy, Malawi, Mauritius, Mozambique, Rhodesia, Rwanda, Somalia, Swaziland, Tanzania, Uganda, and Zambia
WAS	West Asia: Bahrein, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Muscat and Oman, Qatar, Saudi Arabia, South Yemen, Syria, Trucial States, Turkey, and Yemen
SAS	South Asia: Afghanistan, Bhutan, Ceylon, India, Nepal, and Pakistan
EAS	East Asia and Pacific Islands: Brunei, China (Taiwan), Hong Kong, Indonesia, Korea, Macao, Malaysia, Pacific Islands, Papua, Philippines, and Singapore
SEA	Southeast Asia: Burma, Cambodia, Laos, South Vietnam, and Thailand

* The following countries are also classified separately:

ARG	Argentina
UK	United Kingdom

Appendix table 1.--World grain-meat ratio, feed grain consumption, and meat production, by region or country, 1962

Region or country	Grain-meat ratio	Grain used as feed	Meat production
	Kilograms grain per kilogram meat	----- 1,000 metric tons -----	
Developed countries	4.59	180,913	39,395
United States	5.55	99,450	17,925
Canada	6.94	10,404	1,500
EEC	3.79	35,981	9,498
Belgium-Luxembourg	3.94	2,164	549
Netherlands	4.76	3,857	810
France	3.29	12,169	3,698
Germany, West	3.33	10,461	3,139
Italy	5.63	7,330	1,302
EFTA	4.47	21,984	4,915
Austria	3.53	1,516	429
Denmark	4.61	4,863	1,054
Norway	4.66	680	146
Portugal	1.84	289	157
Sweden	6.28	2,561	408
Switzerland	3.65	752	286
United Kingdom	4.65	11,323	2,435
Subtotal less U.K., ..	4.30	10,661	2,480
Other Western Europe	3.81	6,307	1,655
Greece	3.30	641	194
Ireland	1.61	860	535
Spain	6.13	3,637	641
Japan	5.49	4,207	766
South Africa, Republic of:	1.35	962	713
Oceania .....	.55	1,618	2,423
Australia .....	.92	1,458	1,585
New Zealand .....	.19	160	838

Continued

Appendix table 1.--World grain-meat ratio, feed grain consumption, and meat production, by region or country, 1962--continued

Region or country	Grain-meat ratio	Grain- used as feed	Meat production
	Kilograms grain per kilogram meat	----- 1,000 metric tons -----	
Central plan countries ...:	3.60	61,808	17,156
Soviet Union	3.35	24,062	8,060
Eastern Europe	6.32	31,136	4,926
Bulgaria	9.72	1,943	200
Czechoslovakia	6.39	3,998	626
Germany, East	4.49	3,895	867
Hungary	7.49	4,384	585
Poland	5.55	8,068	1,453
Romania	6.22	3,404	547
Yugoslavia	8.64	5,014	580
Communist Asia	1.58	6,610	4,170
China	1.48	5,900	4,000
North Vietnam	6.00	600	100

Continued

Appendix table 1.--World grain-meat ratio, feed grain consumption, and meat production, by region or country, 1962--continued

Region or country	Grain-meat ratio	Grain used as feed	Meat production
	Kilograms grain per kilogram meat	----- 1,000 metric tons -----	
Less developed countries..	1.30	23,958	18,499
Middle America	2.24	3,190	1,425
Mexico	2.41	1,857	771
Costa Rica .....	.56	22	39
El Salvador	2.94	94	32
Guatemala	1.15	62	54
Honduras	3.45	100	29
Nicaragua	1.69	76	45
Panama	1.11	40	36
East South America	1.55	10,342	6,679
Argentina	1.08	3,626	3,357
Brazil	2.53	6,300	2,494
Paraguay .....	.18	28	159
Uruguay .....	.52	216	416
Venezuela .....	.38	79	207
Subtotal less Argentina	2.02	6,716	3,322
West South America .....	.58	768	1,320
Bolivia .....	.72	59	82
Chile	1.26	317	251
Colombia .....	.40	254	630
Ecuador .....	.31	31	100
Peru .....	.42	107	257
North Africa	1.70	1,515	890
Algeria	2.07	180	87
United Arab Republic..	1.10	400	362
Libya	6.91	76	11
Morocco	4.40	734	167
Sudan .....	.03	7	210
Tunisia	2.23	118	53

Continued

Appendix table 1.--World grain-meat ratio, feed grain consumption, and meat production, by region or country, 1962--continued

Region or country	Grain-meat ratio	Grain used as feed	Meat production
	Kilograms grain per kilogram meat	----- 1,000 metric tons -----	
West Africa .....	.09	106	1,151
Cameroon .....	.32	21	65
Central African Repub.:	.06	1	18
Chad	---	---	79
Congo (Brazzaville) ...	---	---	6
Dahomey	---	---	11
Gabon	---	---	11
Gambia	1.00	2	2
Ghana .....	.08	3	40
Ivory Coast .....	.10	2	21
Mali	---	---	68
Mauritania	---	---	54
Niger	---	---	74
Nigeria .....	.15	52	339
Senegal .....	.03	1	34
Togo	---	---	14
Upper Volta	---	---	55
East Africa .....	.32	491	1,539
Ethiopia .....	.38	170	452
Kenya .....	.53	88	167
Malagasy .....	.15	15	98
Malawi.....	---	---	14
Rhodesia .....	.41	90	220
Tanzania .....	.47	61	130
Uganda .....	.17	14	83
Zambia .....	.29	9	31

Continued

Appendix table 1.--World grain-meat ratio, feed grain consumption, and meat production, by region or country, 1962--continued

Region or country	Grain-meat ratio	Grain used as feed	Meat production
	Kilograms grain per kilogram meat	----- 1,000 metric tons -----	
West Asia	3.05	5,349	1,755
Iran	1.72	580	337
Iraq	3.71	494	133
Israel	5.68	443	78
Jordan .....	.95	20	21
Lebanon .....	.75	46	61
Saudia Arabia	---	---	65
Syria	1.81	123	68
Turkey	8.35	3,606	390
Yemen	---	---	---
South Asia .....	.82	1,163	1,410
Afghanistan .....	.63	100	158
Ceylon .....	.12	3	26
India	1.26	958	763
Pakistan .....	.21	83	400
East Asia-Pacific Islands .....	.52	820	1,565
Indonesia .....	.48	255	535
Korea .....	.71	112	119
Malaysia .....	.50	47	94
Philippines .....	.57	250	439
Taiwan .....	.43	105	243
Southeast Asia .....	.28	214	765
Burma	1.31	118	90
Thailand .....	.07	30	439
World total	3.55	266,679	75,050

Source: Calculations based on tables 2 and 3.

Appendix table 2.--World grain production, trade, and utilization, by region or country, 1962

Region or country	: Production :	: Net imports :	: Stock change :	: Total supply :	Utilization		
					: Feed :	: Industry, other :	: Human food :
----- 1,000 metric tons -----							
Developed countries	311,319	(13,346)	4,861	293,112	180,913	47,413	64,786
United States	156,283	(23,599)	4,741	127,943	99,450	16,304	12,189
Canada	25,780	(10,529)	515	14,736	10,404	3,073	1,259
European Community	56,041	10,186	81	66,308	35,981	12,909	17,418
Belgium-Luxembourg	1,983	1,690	1	3,672	2,164	666	842
Netherlands	1,894	3,457	1	5,350	3,857	572	921
France	24,168	(3,962)	-100	20,306	12,169	3,616	4,521
Germany, West	14,579	4,272	-176	19,027	10,461	4,140	4,426
Italy	13,417	4,729	193	17,953	7,330	3,915	6,703
EFTA	25,470	10,956	-179	36,605	21,984	6,809	7,812
Austria	2,283	609	-2	2,894	1,516	648	730
Denmark	5,536	603	-33	6,172	4,863	946	363
Norway	590	546	0	1,136	680	175	281
Portugal	1,562	201	-22	1,785	289	442	1,054
Sweden	3,848	(183)	-40	3,705	2,561	603	541
Switzerland	586	1,010	-2	1,598	752	315	531
United Kingdom	11,065	8,170	-80	19,315	11,323	3,680	4,312
Subtotal less U.K.	14,405	2,786	-99	17,290	10,661	3,129	3,500
Other Western Europe	14,118	1,419	-337	15,874	6,307	2,256	7,302
Greece	2,553	(81)	-109	2,581	641	360	1,580
Ireland	1,308	256	-6	1,570	860	407	303
Spain	8,268	1,036	-134	9,438	3,637	1,126	4,675
Japan	16,080	6,881	282	22,679	4,207	4,317	14,155
South Africa, Republic of	7,088	(2,385)	-80	4,783	962	683	3,138
Oceania	10,459	(6,275)	---	4,184	1,618	1,053	1,513
Australia	10,099	(6,456)	---	3,643	1,458	874	1,311
New Zealand	360	181	---	541	160	174	202

Continued--

Appendix table 2.--World grain production, trade, and utilization, by region or country, 1962 -- continued

Region or country	Production:	Net imports	Stock change	Total supply	Feed	Utilization	
						: Industry,	: Human food
	---	---	---	1,000 metric tons	---	---	---
Central plan countries	275,995	1,056	-3,261	280,312	61,808	51,528	166,976
Soviet Union	97,901	(6,213)	-3,746	95,434	24,062	27,480	43,892
Eastern Europe	59,794	5,769	485	65,078	31,136	10,598	23,344
Bulgaria	4,708	(58)	-65	4,715	1,943	737	2,035
Czechoslovakia	5,637	1,965	---	7,602	3,998	1,299	2,305
Germany, East	5,723	1,783	---	7,496	3,895	1,251	2,350
Hungary	6,763	307	---	7,070	4,384	837	1,849
Poland	15,127	2,124	83	17,168	8,068	3,205	5,895
Romania	10,352	(666)	300	9,386	3,404	1,600	4,382
Yugoslavia	10,668	242	167	10,743	5,014	1,523	4,206
Communist Asia	118,300	1,500	---	119,800	6,610	13,450	99,740
China	113,000	1,500	---	114,500	5,900	13,048	95,552
North Vietnam	3,340	---	---	3,340	600	100	2,640

Continued--

Appendix table 2.--World grain production, trade, and utilization, by region or country, 1962 -- continued

Region or country	: Production :	: Net imports :	: Stock change :	: Total supply :	Utilization		
					: Feed :	: Industry, :	: Human food :
					----- 1,000 metric tons -----		
North Africa	13,590	2,458	-525	16,573	1,515	1,761	13,297
Algeria	1,793	455	---	2,248	180	196	1,872
United Arab Republic	6,440	1,590	---	8,030	400	660	6,970
Libya	152	131	---	283	76	23	184
Morocco	2,757	255	-200	3,212	734	543	1,935
Sudan	1,678	(26)	-325	1,977	7	141	1,829
Tunisia	770	53	---	823	118	198	507
West Africa	17,198	947	---	18,145	106	1,672	16,367
Cameroon	540	30	---	570	21	68	481
Central African Republic	61	4	---	65	1	6	58
Chad	688	5	---	693	---	97	596
Congo (Brazzaville)	9	14	---	23	---	1	22
Dahomey	286	9	---	295	---	33	262
Gabon	3	11	---	14	---	---	14
Gambia	71	17	---	88	2	12	74
Ghana	379	150	---	529	3	56	470
Ivory Coast	405	87	---	492	2	52	438
Mali	1,129	(16)	---	1,113	---	199	914
Mauritania	65	44	---	109	---	6	103
Niger	764	(36)	---	728	---	101	627
Nigeria	7,386	128	---	7,514	52	454	7,008
Senegal	451	264	---	715	1	74	640
Togo	185	13	---	198	---	32	166
Upper Volta	889	9	---	898	---	103	795

Continued--

Appendix table 2.--World grain production, trade, and utilization, by region or country, 1962 -- continued

Region or country	: Production :	: Net imports :	: Stock change :	: Total supply :	: Utilization :		
					: Feed :	: Industry, other :	: Human food :
					----- 1,000 metric tons -----		
East Africa	15,780	105	---	15,885	491	2,902	12,492
Ethiopia	4,615	4	---	4,619	170	967	3,482
Kenya	1,564	(24)	---	1,540	88	213	1,239
Malagasy	1,443	(25)	---	1,418	15	186	1,217
Malawi	720	(16)	---	704	---	63	641
Rhodesia	2,020	(33)	---	1,987	90	152	1,745
Tanzania	1,595	85	---	1,680	61	277	1,342
Uganda	847	17	---	864	14	372	478
Zambia	692	36	---	728	9	103	616
West Asia	21,136	2,456	65	23,527	5,349	5,176	13,002
Iran	4,479	506	---	4,985	580	801	3,604
Iraq	1,902	163	---	2,065	494	551	1,020
Israel	141	657	10	788	443	206	139
Jordan	141	208	---	349	20	43	286
Lebanon	88	298	---	386	46	40	300
Saudi Arabia	236	320	---	556	---	38	518
Syria	1,377	149	---	1,526	123	524	879
Turkey	11,769	37	---	11,751	3,606	2,901	5,244
Yemen	1,003	18	55	1,021	---	72	949

Continued--

Source: see app. table 11.

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Source: see app. table 11.

Appendix table 3.--World meat production, trade, and utilization, by region or country, 1962

Region or country	Production:	Net imports:	Stock change:	Total supply:	Utilization		
					Feed	Industry, other	Human food
				1,000 metric tons			
Developed countries	39,395	205	16	39,584	---	2,792	36,792
United States	17,925	32	-15	17,972	---	2,428	15,544
Canada	1,500	20	5	1,515	---	33	1,482
European Community	9,498	700	-1	10,199	---	---	10,199
Belgium-Luxembourg	549	37	---	586	---	---	586
Netherlands	810	(205)	-1	606	---	---	606
France	3,698	39	5	3,732	---	---	3,732
Germany, West	3,139	491	-5	3,635	---	---	3,635
Italy	1,302	338	---	1,640	---	---	1,640
EFTA	4,915	(648)	-3	5,566	---	33	5,533
Austria	429	6	-1	436	---	---	436
Denmark	1,054	(755)	-3	302	---	5	297
Norway	146	---	-1	147	---	1	146
Portugal	157	12	---	169	---	4	165
Sweden	408	(19)	---	389	---	---	389
Switzerland	286	67	---	353	---	---	353
United Kingdom	2,435	1,337	2	3,770	---	23	3,747
Subtotal less U.K.	2,480	(689)	-5	1,796	---	10	1,786
Other Western Europe	1,655	(328)	-1	1,326	---	---	1,326
Greece	194	55	---	249	---	---	249
Ireland	535	(348)	-1	188	---	---	188
Spain	641	33	---	674	---	---	674
Japan	766	58	---	824	---	147	677
South Africa, Republic of	713	(54)	4	771	---	6	765
Oceania	2,423	(985)	27	1,411	---	145	1,266
Australia	1,585	(467)	1	1,117	---	118	999
New Zealand	838	(518)	26	294	---	27	267

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Appendix table 3.--World meat production, trade, and utilization, by region or country, 1962 -- Continued

Region or country	:	Production:	:	Net imports:	:	Stock change:	:	Total supply:	:	Utilization		
										Feed	Industry,	Human
										:	other	: food
----- 1,000 metric tons -----												
North Africa	:	890	:	23	:	--	:	913	:	--	:	913
Algeria	:	87	:	--	:	--	:	87	:	--	:	87
United Arab Republic	:	362	:	23	:	--	:	385	:	--	:	385
Libya	:	11	:	--	:	--	:	11	:	--	:	11
Morocco	:	167	:	--	:	--	:	167	:	--	:	167
Sudan	:	210	:	--	:	--	:	210	:	--	:	210
Tunisia	:	53	:	--	:	--	:	53	:	--	:	53
West Africa	:	1,151	:	11	:	--	:	1,162	:	--	:	1,162
Cameroon	:	65	:	2	:	--	:	67	:	--	:	67
Central African Republic	:	18	:	2	:	--	:	20	:	--	:	20
Chad	:	79	:	(32)	:	--	:	47	:	--	:	47
Congo (Brazzaville)	:	6	:	4	:	--	:	10	:	--	:	10
Dahomey	:	11	:	2	:	--	:	13	:	--	:	13
Gabon	:	11	:	1	:	--	:	12	:	--	:	12
Gambia	:	2	:	--	:	--	:	2	:	--	:	2
Ghana	:	40	:	35	:	--	:	75	:	--	:	75
Ivory Coast	:	21	:	17	:	--	:	38	:	--	:	38
Mali	:	68	:	(18)	:	--	:	50	:	--	:	50
Mauritania	:	54	:	(24)	:	--	:	30	:	--	:	30
Niger	:	74	:	(28)	:	--	:	46	:	--	:	46
Nigeria	:	339	:	49	:	--	:	388	:	--	:	388
Senegal	:	34	:	14	:	--	:	48	:	--	:	48
Togo	:	14	:	--	:	--	:	14	:	--	:	14
Upper Volta	:	55	:	(16)	:	--	:	39	:	--	:	39

Continued--

Appendix table 3.--World meat production, trade, and utilization, by region or country, 1962 -- continued

Region or country	: Production :	: Net imports :	: Stock change :	: Total supply :	Utilization		
					: Feed :	: Industry, : Human	: other : food
----- 1,000 metric tons -----							
East Africa	1,539	(49)	---	1,490	---	---	1,490
Ethiopia	452	(3)	---	449	---	---	449
Kenya	167	(14)	---	153	---	---	153
Malagasy	98	(6)	---	92	---	---	92
Malawi	14	1	---	15	---	---	15
Rhodesia	220	(14)	---	206	---	---	206
Tanzania	130	(7)	---	123	---	---	123
Uganda	83	---	---	83	---	---	83
Zambia	31	5	---	36	---	---	36
West Asia	1,755	18	---	1,773	---	---	1,773
Iran	337	---	---	337	---	---	337
Iraq	133	---	---	133	---	---	133
Israel	78	13	---	91	---	---	91
Jordan	21	---	---	21	---	---	21
Lebanon	61	---	---	61	---	---	61
Saudi Arabia	65	---	---	65	---	---	65
Syria	68	---	---	68	---	---	68
Turkey	390	---	---	390	---	---	390
Yemen		---	---	---	---	---	---

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Appendix table 3.--World meat production, trade, and utilization, by region or country, 1962 -- Continued

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Source: see app. table 11.

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962

Region or country	Self-sufficiency			Distribution of grain consumption			
	Grain	Meat		Industry, other	Feed	Human food	
							Percent
Developed countries	106.2	99.5		16.2	61.7	22.1	
United States	122.2	99.7		12.8	77.7	9.5	
Canada	173.6	99.0		20.9	70.6	8.5	
European Community	84.5	93.1		19.4	54.3	26.3	
Belgium-Luxembourg	54.0	93.7		18.2	58.9	22.9	
Netherlands	35.4	133.7		10.7	72.1	17.2	
France	119.0	99.1		17.8	59.9	22.3	
Germany, West	76.6	86.4		21.8	54.9	23.3	
Italy	74.7	79.4		21.8	40.8	37.4	
EFTA	69.6	88.3		18.6	60.1	21.3	
Austria	78.9	98.4		22.4	52.4	25.2	
Denmark	89.7	349.0		15.3	78.8	5.9	
Norway	51.9	99.3		15.4	59.9	24.7	
Portugal	87.5	92.9		24.8	16.2	59.0	
Sweden	103.8	104.8		16.3	69.1	14.6	
Switzerland	36.7	81.0		19.7	47.1	33.2	
United Kingdom	57.3	64.6		19.1	58.6	22.3	
Subtotal less U.K.	83.3	138.1		18.1	61.7	20.2	
Other Western Europe	88.9	124.8		14.3	39.7	46.0	
Greece	98.9	77.9		13.9	24.8	61.3	
Ireland	83.3	284.6		25.9	54.8	19.3	
Spain	87.6	95.1		11.9	38.5	49.6	
Japan	70.9	92.9		19.0	18.6	62.4	
South Africa, Republic of	148.2	92.5		14.3	20.1	65.6	
Oceania	250.0	171.7		25.2	38.6	36.2	
Australia	277.2	141.8		24.0	40.0	36.0	
New Zealand	66.5	285.0		33.1	29.6	37.3	

Continued--

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962 -- continued

Region or country	Self-sufficiency			Distribution of grain consumption			
	Grain	Meat		Feed	Industry, other	Human food	
							Percent
Central plan countries	98.5	97.5		22.0	18.4	59.6	
Soviet Union	102.6	100.3		25.2	28.8	46.0	
Eastern Europe	91.9	101.7		47.8	16.3	35.9	
Bulgaria	99.6	108.6		41.2	15.6	43.2	
Czechoslovakia	74.2	86.2		52.6	17.1	30.3	
Germany, East	76.3	90.9		52.0	16.7	31.3	
Hungary	95.7	104.2		62.0	11.8	26.2	
Poland	88.1	109.6		47.0	18.7	34.3	
Romania	101.3	104.4		36.3	17.0	46.7	
Yugoslavia	99.3	115.7		46.6	14.2	39.2	
Communist Asia	98.7	100.0		5.5	11.2	83.3	
China	98.7	100.0		5.2	11.4	83.4	
North Vietnam	100.0	100.0		18.0	3.0	79.0	

Continued--

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962 -- continued

Region or country	Self-sufficiency		Distribution of grain consumption			
	Grain	Meat	Feed	Industry, other	Human food	
			Percent			
Less developed countries	96.6	104.7	8.0	13.1	78.9	
Middle America	96.1	104.5	20.3	20.3	59.4	
Mexico	97.9	104.5	20.5	23.9	55.6	
Costa Rica	73.3	114.7	13.7	12.4	73.9	
El Salvador	87.2	100.0	20.3	9.4	70.3	
Guatemala	89.9	108.0	8.7	10.3	81.0	
Honduras	99.2	87.9	26.6	9.6	63.8	
Nicaragua	90.3	125.0	32.1	12.6	55.3	
Panama	83.2	92.3	18.2	22.3	59.5	
East South America	109.0	113.3	36.3	11.4	52.3	
Argentina	156.0	125.7	42.1	20.2	37.7	
Brazil	89.6	102.3	35.6	7.0	57.4	
Paraguay	64.3	119.5	12.3	14.0	73.6	
Uruguay	104.7	121.6	29.2	21.0	49.8	
Venezuela	61.6	77.2	8.5	4.9	86.6	
Subtotal less Argentina	86.6	103.0	33.8	7.6	58.6	
West South America	85.4	98.3	11.9	12.0	76.1	
Bolivia	73.9	98.8	9.6	13.1	77.3	
Chile	90.6	84.2	17.4	12.0	70.6	
Colombia	92.0	109.2	12.7	12.0	75.3	
Ecuador	97.8	101.0	5.8	20.6	73.6	
Peru	70.8	89.9	7.1	8.8	84.1	

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962 -- continued

Region or country	Self-sufficiency		Distribution of grain consumption			
	Grain	Meat	Feed	Industry, other	Human food	
<hr/>						
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North Africa	82.0	97.5	9.2	10.6	80.2	
Algeria	79.8	100.0	8.0	8.7	83.3	
United Arab Republic	80.2	94.0	5.0	8.2	86.8	
Libya	53.7	100.0	26.9	8.1	65.0	
Morocco	85.8	100.0	22.9	16.9	60.2	
Sudan	84.9	100.0	.4	7.1	92.5	
Tunisia	93.6	100.0	14.3	24.1	61.6	
West Africa	94.8	99.1	.6	9.2	90.2	
Cameroon	94.7	97.0	3.7	11.9	84.4	
Central African Republic	93.8	90.0	1.5	9.3	89.2	
Chad	99.3	168.1	---	14.0	86.0	
Congo (Brazzaville)	39.1	60.0	---	4.3	95.7	
Dahomey	96.9	84.6	---	11.2	88.8	
Gabon	21.4	91.7	---	---	100.0	
Gambia	80.7	100.0	2.3	13.6	84.1	
Ghana	71.6	53.3	.6	10.6	88.8	
Ivory Coast	82.3	52.3	.4	10.6	89.0	
Mali	101.4	136.0	---	17.8	82.2	
Mauritania	59.6	180.0	---	5.5	94.5	
Niger	104.9	160.8	---	13.9	86.1	
Nigeria	98.3	87.4	.7	6.0	93.3	
Senegal	63.1	70.8	.2	10.3	89.5	
Togo	93.4	100.0	---	16.2	83.8	
Upper Volta	98.9	141.0	---	11.5	88.5	

Continued--

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962 -- continued

Region or country	Self-sufficiency			Distribution of grain consumption			
	Grain	Meat		Feed	Industry, other	Human food	
							Percent
East Africa	99.3	103.7		3.1	18.3		78.6
Ethiopia	82.1	102.7		3.7	20.9		75.4
Kenya	101.5	109.2		5.7	13.8		80.5
Malagasy	101.7	106.5		1.1	13.1		85.8
Malawi	102.2	93.3		---	8.9		91.1
Rhodesia	101.7	106.8		4.5	7.6		87.8
Tanzania	94.9	105.7		3.6	16.5		79.9
Uganda	98.0	100.0		1.6	43.0		55.3
Zambia	95.0	86.1		1.2	14.1		84.6
West Asia	89.8	99.0		22.7	22.0		55.3
Iran	89.8	100.0		11.6	16.1		72.3
Iraq	92.1	85.7		23.9	26.7		49.4
Israel	17.9	100.0		56.2	26.2		17.6
Jordan	40.4	100.0		5.7	12.4		81.9
Lebanon	22.8	100.0		11.9	10.4		77.7
Saudi Arabia	42.4	100.0		---	6.8		93.2
Syria	90.2	100.0		8.1	34.3		57.6
Turkey	100.1	100.0		30.7	24.7		44.6
Yemen	98.2	---		---	7.1		92.9

Continued--

Appendix table 4.--World self-sufficiency in grain and meat, and percentage distribution of grain consumption, by region or country, 1962 -- continued

Region or country	Self-sufficiency			Distribution of grain consumption			
	Grain	Meat	Feed	Industry, other	Human food		
						Percent	
South Asia	94.5	100.0	.9	13.3		85.8	
Afghanistan	99.0	100.0	2.7	16.4		80.9	
Ceylon	53.1	100.0	.2	6.1		93.7	
India	95.1	100.0	1.1	14.0		84.9	
Pakistan	95.0	100.0	.4	10.6		89.0	
East Asia-Pacific Islands	89.7	98.7	2.3	5.7		92.0	
Indonesia	94.6	100.1	1.6	5.7		92.7	
Korea	89.0	100.0	1.6	5.0		93.4	
Malaysia	50.9	100.0	2.9	3.0		94.1	
Philippines	89.0	96.7	4.3	6.8		88.9	
Taiwan	91.0	102.1	3.6	7.2		89.2	
Southeast Asia	130.0	106.1	1.1	14.2		84.7	
Burma	131.5	100.0	2.0	18.6		79.4	
Thailand	131.4	107.3	.4	10.4		89.2	
World total	100.4	101.1	30.5	15.9		53.6	

Source: see app. table 11.

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962

Region or country	:Percentage distribution of meat production: Selected joint-product ratios									
	: Pork	: Poultry	: Bovine	: Other	: Total	: Milk-: beef	: Milk-: meat	: Egg-: poultry	: Egg-: meat	
	Percent									
Developed countries	31	14	40	15	100	11.8	4.8	1.6	.2	
United States	30	18	43	9	100	7.3	3.2	1.2	.2	
Canada	30	17	46	7	100	12.0	5.5	1.1	.2	
European Community	39	11	37	13	100	11.2	7.1	1.9	.2	
Belgium-Luxembourg	38	15	36	11	100	20.9	7.5	1.9	.3	
Netherlands	51	12	30	7	100	28.7	8.7	1.2	.4	
France	27	13	41	19	100	16.7	6.9	1.1	.1	
Germany, West	25	4	33	8	100	20.2	6.5	4.3	.2	
Italy	26	20	40	14	100	19.3	7.6	1.6	.3	
EFTA	38	10	34	18	100	18.0	6.1	2.4	.2	
Austria	56	6	34	4	100	20.5	7.0	3.4	.2	
Denmark	64	7	23	6	100	21.9	5.0	1.4	.1	
Norway	38	2	39	21	100	29.4	11.5	10.7	.2	
Portugal	32	7	29	32	100	10.1	2.9	11.6	.2	
Sweden	52	4	37	7	100	25.2	9.2	6.3	.2	
Switzerland	48	3	38	11	100	36.8	10.8	3.6	.1	
United Kingdom	21	14	38	27	100	14.8	5.2	.9	.3	
Subtotal less U.K.	55	6	30	9	100	23.1	7.0	2.7	.2	
Other Western Europe	25	9	37	29	100	13.9	5.2	2.8	.3	
Greece	21	11	22	36	100	19.2	5.3	2.6	.2	
Ireland	21	3	56	20	100	9.5	5.3	2.6	.1	
Spain	18	17	27	38	100	16.9	4.5	2.3	.4	
Japan	35	15	22	28	100	14.2	3.2	6.7	1.0	
South Africa, Republic of	8	4	66	22	100	5.6	3.7	2.4	.1	
Oceania	70	21	4	5	100	11.9	4.9	3.0	.1	
Australia	8	3	46	43	100	8.8	4.0	2.5	.1	
New Zealand	1	5	31	63	100	29.6	6.4	8.5	---	

Continued--

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962 -- continued

Region or country	:Percentage distribution of meat production:					Selected joint-product ratios			
	: Pork	: Poultry	: Bovine	: Other	: Total	: Milk-: beef	: Milk-: meat	: Egg-: poultry	: Egg-: meat
	:-----					----- Percent -----			
Central plan countries	45	9	32	14	100	15.3	5.0	1.9	.2
Soviet Union	33	10	43	14	100	15.1	6.5	2.0	.2
Eastern Europe	57	10	25	8	100	25.6	6.3	20.9	.2
Bulgaria	39	20	34	7	100	16.1	5.5	1.5	.3
Czechoslovakia	60	9	22	9	100	27.7	6.1	2.2	.2
Germany, East	61	8	22	9	100	31.6	6.9	2.5	.2
Hungary	56	17	19	8	100	18.4	3.4	1.0	.2
Poland	66	4	21	9	100	41.6	8.6	4.1	.2
Romania	42	13	36	9	100	14.2	5.1	1.7	.2
Yugoslavia	46	11	34	9	100	12.8	4.3	1.2	.1
Communist Asia	53	6	21	20	100	1.4	.3	1.5	.1
China	53	6	21	20	100	1.4	.3	1.5	.1
North Vietnam	---	---	---	---	100	---	---	---	---
									Continued --

Continued --

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962 -- continued

Region or country	:Percentage distribution of meat production: Selected joint-product ratios									
	: Pork	: Poultry	: Bovine	: Other	: Total	: Milk-: beef	: Milk-: meat	: Egg-: poultry	: Egg-: meat	
					Percent					
Less developed countries	16	7	56	21	100	7.1	4.0	1.9	.1	
Middle America	28	6	60	6	100	5.2	3.1	3.5	.2	
Mexico	32	6	54	8	100	5.6	3.0	4.4	.3	
Costa Rica	8	5	87	---	100	3.6	3.1	1.5	.1	
El Salvador	31	6	63	---	100	5.5	3.4	4.0	.3	
Guatemala	15	6	75	4	100	3.6	2.7	2.7	.2	
Honduras	24	10	66	---	100	6.7	4.4	3.0	.3	
Nicaragua	14	4	82	---	100	5.2	4.3	2.0	.1	
Panama	11	6	83	---	100	1.7	1.4	2.5	.1	
East South America	13	3	77	7	100	2.2	1.7	1.8	.1	
Argentina	4	1	87	8	100	1.6	1.4	4.5	---	
Brazil	25	6	66	3	100	3.3	2.2	1.5	---	
Paraguay	13	4	82	1	100	.6	.5	1.2	.1	
Uruguay	5	1	78	16	100	2.2	1.7	4.8	.1	
Venezuela	20	12	68	---	100	3.5	2.4	1.0	.1	
Subtotal less Argentina ..	21	6	68	5	100	3.0	2.1	1.5	.1	
West South America	15	4	67	14	100	3.9	2.6	2.0	.1	
Bolivia	15	1	48	37	100	2.2	1.1	4.0	.1	
Chile	14	4	57	25	100	5.6	3.2	2.3	.1	
Colombia	12	4	83	1	100	3.5	3.0	2.1	.1	
Ecuador	30	5	50	15	100	4.4	2.2	1.8	.1	
Peru	19	6	51	24	100	3.9	2.0	1.7	.1	

Continued --

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962 -- continued

Region or country	:Percentage distribution of meat production: Selected joint-product ratios									
	: Pork	: Poultry	: Bovine	: Other	: Total	: Milk- : beef	: Milk- : meat	: Egg- : poultry	: Egg- : meat	
					Percent					
North Africa	1	14	42	43	100	11.6	4.9	1.2	.2	
Algeria	10	30	31	29	100	17.1	5.3	.5	.1	
United Arab Republic	---	31	50	19	100	8.2	4.1	.4	.1	
Libya	---	---	34	66	100	12.3	4.5	---	.2	
Morocco	2	4	44	50	100	7.2	3.2	7.1	.3	
Sudan	---	5	34	61	100	23.3	8.0	2.0	.1	
Tunisia	---	2	36	57	100	7.3	2.6	3.8	.3	
West Africa	7	9	44	40	100	3.0	1.3	1.0	.1	
Cameroon	14	5	39	42	100	1.2	.5	.7	---	
Central African Republic ..	---	6	50	44	100	.3	.2	---	---	
Chad	1	1	69	29	100	2.2	1.5	2.0	---	
Congo (Brazzaville)	---	---	50	50	100	---	---	---	.2	
Dahomey	20	10	30	40	100	.7	.2	1.0	.1	
Gabon	---	---	10	90	100	1.0	.1	---	---	
Gambia	---	---	50	50	100	2.0	1.0	---	---	
Ghana	8	13	16	63	100	.7	.1	.8	.1	
Ivory Coast	15	10	15	60	100	2.0	.3	1.0	.1	
Mali	2	7	52	39	100	4.1	2.1	.6	---	
Mauritania	---	4	36	60	100	8.6	3.0	.5	---	
Niger	---	6	55	39	100	5.5	3.1	1.0	.1	
Nigeria	10	15	43	32	100	2.2	1.0	1.0	.2	
Senegal	7	7	62	24	100	4.5	2.8	1.0	.1	
Togo	29	7	14	50	100	.5	.1	1.0	.1	
Upper Volta	8	4	38	50	100	2.5	1.0	1.0	---	

Continued --

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962 -- continued

Region or country	:Percentage distribution of meat production: Selected joint-product ratios									
	Pork	Poultry	Bovine	Other	Total	Milk- beef	Milk- meat	Egg- poultry	Egg- meat	
	Percent									
East Africa	4	6	62	28	100	3.7	2.3	1.4	.1	
Ethiopia	---	11	53	36	100	6.9	3.7	.9	.1	
Kenya	9	4	62	25	100	4.1	2.6	.7	.1	
Malagasy	14	---	66	20	100	.5	.3	---	.1	
Malawi	35	15	30	20	100	6.8	1.9	1.0	.1	
Rhodesia	---	---	68	32	100	1.4	.9	---	.1	
Tanzania	4	4	84	8	100	1.7	1.4	1.6	.1	
Uganda	2	2	65	31	100	2.8	1.8	2.5	.1	
Zambia	15	15	58	12	100	3.3	1.9	.6	.1	
West Asia	---	6	30	64	100	24.3	7.2	3.0	.2	
Iran	---	11	29	40	100	21.6	6.3	1.0	.1	
Iraq	---	3	32	65	100	28.1	9.1	2.5	.1	
Israel	---	---	18	82	100	21.1	3.8	---	1.0	
Jordan	---	9	18	73	100	15.5	3.0	1.0	.1	
Lebanon	---	23	41	36	100	2.8	1.2	.1	---	
Syria	---	5	15	80	100	31.5	4.6	2.3	.1	
Turkey	---	---	37	63	100	20.7	7.6	---	1.7	
										Continued

Continued --

Appendix table 5.--World livestock production, percentage distribution by type of meat, and selected joint-product ratios, by region or country, 1962 -- continued

:Percentage distribution of meat production: Selected joint-product ratios									
Region or country	Pork	Poultry	Bovine	Other	Total	Milk- : beef	Milk- : meat	Egg- : poultry	Egg- : meat
:	:	:	:	:	:	:	:	:	:
:	----- Percent -----								
South Asia	3	11	42	44	100	55.2	23.1	1.0	.1
Afghanistan	---	3	28	69	100	28.4	7.9	3.0	.1
Ceylon	13	13	56	18	100	9.0	5.2	3.3	.4
India	4	12	31	53	100	91.8	28.5	.9	.1
Pakistan	---	11	67	22	100	29.9	20.0	.6	.1
East Asia-Pacific Islands	71	13	13	3	100	.3	---	2.1	.3
Indonesia	---	---	---	---	100	---	.1	---	.4
Korea	57	12	26	5	100	.2	---	2.5	.3
Malaysia	44	40	14	2	100	1.1	.2	.6	.2
Philippines	73	11	16	---	100	.1	---	1.7	.2
Taiwan	87	9	3	1	100	1.0	---	1.0	.1
Southeast Asia	36	12	46	6	100	.7	.3	3.2	.4
Burma	---	---	---	---	100	---	4.0	---	1.1
Thailand	36	12	46	6	100	---	---	2.0	.2
World total	31	11	42	16	100	10.9	4.6	1.7	.2

Source: see app. table 11.

Appendix table 6.--World consumption of grain by livestock, percentage distribution by type of grain,
by region or country, 1962

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	Percent							
Developed countries	6.1	.2	54.7	16.1	2.0	17.2	3.7	100.0
United States	.9	.2	80.4	5.3	.2	12.9	.1	100.0
Canada	13.2	---	10.6	23.4	.8	51.8	.2	100.0
European Community	13.7	.1	30.4	22.2	7.8	20.5	5.3	100.0
Belgium-Luxembourg	2.0	---	23.7	20.3	8.6	23.4	22.0	100.0
Netherlands	6.3	.2	38.2	9.8	11.1	13.2	21.2	100.0
France	23.5	.1	18.0	32.2	2.5	20.2	3.5	100.0
Germany, West	16.2	---	8.6	24.7	17.4	31.8	1.3	100.0
Italy	1.1	---	80.1	9.3	.9	7.9	.7	100.0
EFTA	11.3	---	19.3	43.9	1.4	16.9	7.2	100.0
Austria	6.6	---	33.5	33.4	2.8	19.7	4.0	100.0
Denmark	2.6	---	3.5	60.9	4.1	12.6	16.3	100.0
Norway	9.3	---	13.1	54.0	.1	15.6	7.9	100.0
Portugal	---	---	67.8	10.4	---	21.5	.3	100.0
Sweden	5.5	---	1.9	33.0	2.4	39.2	18.0	100.0
Switzerland	14.0	---	16.6	42.2	1.6	19.9	5.7	100.0
United Kingdom	17.1	---	27.4	40.8	---	13.1	1.6	100.0
Subtotal less U.K.	5.0	---	10.7	47.2	2.9	20.9	13.3	100.0
Other Western Europe	2.8	.1	27.1	46.2	4.2	17.6	2.0	100.0
Greece	3.1	.8	37.7	37.6	.8	20.0	---	100.0
Ireland	11.4	---	13.5	37.2	.1	37.7	.1	100.0
Spain	.1	---	31.9	50.0	5.9	11.6	.5	100.0
Japan	13.2	.5	---	16.7	---	---	69.6	100.0
South Africa, Republic of	.5	---	91.8	1.6	.4	5.3	.4	100.0
Oceania	31.6	---	7.6	11.9	---	39.9	9.0	100.0
Australia	27.0	---	8.0	12.0	---	43.0	10.0	100.0
New Zealand	73.8	---	3.8	11.2	---	11.2	---	100.0

Continued--

Appendix table 6.--World consumption of grain by livestock, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
Central plan countries	9.1	---	30.8	21.1	10.5	17.5	11.0	100.0
Soviet Union	6.2	---	25.5	27.8	5.7	27.8	7.0	100.0
Eastern Europe	12.6	---	37.9	13.2	16.3	12.7	7.3	100.0
Bulgaria	7.4	---	61.7	21.5	1.2	7.8	.4	100.0
Czechoslovakia	26.6	---	15.4	17.3	9.0	---	31.7	100.0
Germany, East	30.2	---	---	16.9	15.0	23.2	14.7	100.0
Hungary	8.0	---	69.7	18.4	---	3.9	---	100.0
Poland	9.4	---	.2	9.6	50.0	26.2	4.6	100.0
Romania	4.4	---	79.5	9.4	---	6.7	---	100.0
Yugoslavia	4.3	---	81.0	7.8	---	6.5	.4	100.0
Communist Asia	3.0	---	17.0	34.0	---	3.0	43.0	100.0
China	3.0	---	17.0	34.0	---	3.0	43.0	100.0
North Vietnam	3.0	---	17.0	34.0	---	3.0	43.0	100.0

Continued--

Appendix table 6.---World consumption of grain by livestock, percentage distribution by type of grain, by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	<u>Percent</u>							
Less developed countries	6.3	2.6	51.6	22.8	1.6	3.4	11.7	100.0
Middle America	19.9	2.8	52.3	2.3	---	1.3	21.3	100.0
Mexico	22.8	1.4	54.0	2.8	---	1.6	17.4	100.0
Costa Rica	---	100.0	---	---	---	---	---	100.0
El Salvador	6.4	2.1	13.8	---	---	---	77.7	100.0
Guatemala	24.2	1.6	58.1	---	---	---	16.1	100.0
Honduras	2.0	2.0	59.0	---	---	---	37.0	100.0
Nicaragua	---	3.9	48.7	---	---	---	47.4	100.0
Panama	2.5	20.0	77.5	---	---	---	---	100.0
East South America	1.3	.1	82.8	3.5	3.4	3.4	5.5	100.0
Argentina	3.7	.3	52.8	9.8	9.7	9.8	13.9	100.0
Brazil	---	---	99.4	---	---	---	.6	100.0
Paraguay	---	---	85.7	---	---	---	14.3	100.0
Uruguay	---	---	81.9	---	---	---	18.1	100.0
Venezuela	---	---	100.0	---	---	---	---	100.0
Subtotal less Argentina ...	---	---	99.0	---	---	---	1.0	100.0
West South America	---	---	65.8	---	---	---	34.2	100.0
Bolivia	---	---	83.1	---	---	---	16.9	100.0
Chile	---	---	46.0	---	---	---	53.9	100.0
Colombia	---	---	85.0	---	---	---	15.0	100.0
Ecuador	---	---	67.7	---	---	---	32.3	100.0
Peru	---	---	68.2	---	---	---	31.8	100.0

Continued--

Appendix table 6.--World consumption of grain by livestock, percentage distribution by type of grain,
by region or country, 1926 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- Percent -----							
North Africa	14.1	.1	20.0	59.4	---	2.6	3.8	100.0
Algeria	---	---	.2	8.8	---	.9	.1	100.0
United Arab Republic	---	---	63.0	28.0	---	---	9.0	100.0
Libya	18.4	---	75.0	---	---	---	6.6	100.0
Morocco	23.0	.3	6.1	67.3	---	1.9	1.4	100.0
Sudan	10.0	---	---	---	---	---	90.0	100.0
Tunisia	26.3	---	.8	65.3	---	7.6	---	100.0
West Africa	---	2.4	85.4	---	---	---	12.2	100.0
Cameroon	---	---	52.4	---	---	---	47.6	100.0
Central African Republic	---	---	100.0	---	---	---	---	100.0
Chad	---	---	---	---	---	---	---	---
Congo (Brazzaville)	---	---	---	---	---	---	---	---
Dahomey	---	---	---	---	---	---	---	---
Gabon	---	---	---	---	---	---	---	---
Gambia	---	100.0	---	---	---	---	---	100.0
Ghana	---	---	100.0	---	---	---	---	100.0
Ivory Coast	---	---	100.0	---	---	---	---	100.0
Mali	---	---	---	---	---	---	---	---
Mauritania	---	---	---	---	---	---	---	---
Niger	---	---	100.0	---	---	---	---	100.0
Nigeria	---	---	100.0	---	---	---	---	100.0
Senegal	---	---	---	---	---	---	---	---
Togo	---	---	---	---	---	---	---	---
Upper Volta	---	---	---	---	---	---	---	---

Continued--

Appendix table 6.--World consumption of grain by livestock, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
East Africa	---	---	60.8	1.1	---	---	38.0	100.0
Ethiopia	---	---	28.2	2.9	---	---	68.8	100.0
Kenya	---	---	68.2	---	---	---	31.8	100.0
Malagasy	---	---	100.0	---	---	---	---	100.0
Malawi	---	---	---	---	---	---	---	---
Rhodesia	---	---	88.9	---	---	---	11.1	100.0
Tanzania	---	---	75.4	---	---	---	24.6	100.0
Uganda	---	---	100.0	---	---	---	---	100.0
Zambia	---	---	100.0	---	---	---	---	100.0
West Asia	7.0	---	4.0	69.3	.6	7.1	11.8	100.0
Iran	---	---	.5	97.9	---	---	1.6	100.0
Iraq	---	---	.4	95.9	---	---	3.6	100.0
Israel	4.9	---	28.7	18.1	---	---	48.3	100.0
Jordan	---	---	25.0	65.0	---	---	10.0	100.0
Lebanon	---	---	45.7	30.4	---	8.7	15.2	100.0
Saudi Arabia	---	---	---	---	---	---	---	---
Syria	---	---	6.5	71.5	---	3.3	18.7	100.0
Turkey	9.8	---	1.3	67.8	.9	10.2	9.9	100.0
Yemen	---	---	---	---	---	---	---	---

Continued--

Appendix table 6.--World consumption of grain by livestock, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- Percent -----							
South Asia	12.1	17.9	9.3	31.8	---	---	28.9	100.0
Afghanistan	---	---	---	---	---	---	---	100.0
Ceylon	66.7	33.3	---	---	---	---	---	100.0
India	14.2	21.3	8.6	35.0	---	---	20.9	100.0
Pakistan	---	---	28.9	33.7	---	---	37.3	100.0
East Asia-Pacific Islands	1.3	16.1	68.5	7.2	---	---	6.9	100.0
Indonesia	---	---	100.0	---	---	---	---	100.0
Korea	8.9	---	---	49.1	---	---	42.0	100.0
Malaysia	---	---	100.0	---	---	---	---	100.0
Philippines	---	16.4	83.2	---	---	---	.4	100.0
Taiwan	---	79.0	16.2	---	---	---	4.8	100.0
Southeast Asia	---	79.7	20.3	---	---	---	---	100.0
Burma	---	100.0	---	---	---	---	---	100.0
Thailand	---	---	100.0	---	---	---	---	100.0
World total	6.8	.3	48.9	17.9	3.9	16.0	6.2	100.0

Source: see app. table 11.

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- Percent -----							
Developed countries	31.0	5.3	35.8	13.3	2.3	11.3	1.0	100.0
United States	21.3	1.7	61.3	5.8	.5	9.4	---	100.0
Canada	56.8	---	3.5	14.5	1.1	23.8	.3	100.0
European Community	46.7	.9	11.4	19.1	7.7	13.2	1.0	100.0
Belgium-Luxembourg	43.9	---	.1	24.1	7.5	24.4	---	100.0
Netherlands	36.6	---	---	19.7	18.7	22.5	2.5	100.0
France	48.6	---	10.9	25.9	1.6	10.9	2.1	100.0
Germany, West	31.5	---	.3	22.8	22.7	22.7	---	100.0
Italy	61.6	3.8	27.8	2.0	.7	3.9	.2	100.0
EFTA	24.4	.7	3.1	44.6	4.7	16.7	5.8	100.0
Austria	31.2	---	8.8	25.3	17.0	14.7	3.0	100.0
Denmark	8.8	---	---	58.3	7.5	12.5	12.5	100.0
Norway	3.7	---	---	71.7	.5	23.5	.6	100.0
Portugal	33.6	10.9	36.0	3.6	10.4	5.1	.4	100.0
Sweden	21.8	---	---	28.2	4.2	32.5	13.3	100.0
Switzerland	58.5	---	1.9	16.8	9.0	7.3	6.5	100.0
United Kingdom	29.8	---	---	53.2	.2	15.4	1.4	100.0
Subtotal less U.K.	20.4	1.2	5.4	38.0	8.2	17.6	9.2	100.0
Other Western Europe	49.3	2.6	10.1	23.8	3.9	9.3	1.0	100.0
Greece	69.2	3.0	10.4	9.9	.9	6.1	.5	100.0
Ireland	29.8	---	---	41.3	.1	28.8	---	100.0
Spain	49.5	3.3	11.9	23.4	4.8	6.8	.3	100.0
Japan	8.6	79.2	---	9.9	---	---	2.3	100.0
South Africa, Republic of	9.9	---	85.0	.6	.1	1.4	3.0	100.0
Oceania	67.4	.9	1.8	13.7	---	13.6	2.6	100.0
Australia	67.5	.9	1.7	13.5	---	13.7	2.7	100.0
New Zealand	64.7	---	3.9	21.1	---	10.3	---	100.0

Continued--

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
Central plan countries	32.5	21.6	12.6	8.5	9.6	5.9	9.3	100.0
Soviet Union	51.2	.2	8.6	11.2	14.9	10.4	3.5	100.0
Eastern Europe	28.8	.2	28.4	11.1	20.0	8.1	3.4	100.0
Bulgaria	48.4	.8	31.3	12.7	1.8	4.7	.3	100.0
Czechoslovakia	28.4	---	9.2	28.3	16.9	---	17.2	100.0
Germany, East	22.5	---	---	18.9	33.5	16.5	8.6	100.0
Hungary	27.5	.8	47.9	15.2	5.5	3.1	---	100.0
Poland	16.7	---	.3	8.1	53.6	18.1	3.2	100.0
Romania	36.8	.5	54.3	4.3	1.2	2.9	---	100.0
Yugoslavia	33.8	.3	53.9	5.3	2.4	3.8	.5	100.0
Communist Asia	19.0	50.0	8.0	5.0	---	1.0	16.0	100.0
China	19.0	50.0	8.0	5.0	---	1.0	16.0	100.0
North Vietnam	19.0	50.0	8.0	5.0	---	1.0	16.0	100.0

Continued--

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	<u>Percent</u>							
Less developed countries	15.5	45.7	17.1	3.5	.2	.2	17.8	100.0
Central America	14.4	6.6	71.0	1.8	---	.8	5.4	100.0
Mexico	17.1	3.5	72.7	2.0	---	.9	3.8	100.0
Costa Rica	2.5	96.7	---	.8	---	---	---	100.0
El Salvador	---	5.9	58.6	---	---	---	35.5	100.0
Guatemala	4.0	2.3	91.8	1.9	---	---	---	100.0
Honduras .....	.2	6.2	78.5	---	---	---	51.1	100.0
Nicaragua	---	60.7	17.3	---	---	---	22.0	100.0
Panama	---	59.6	40.4	---	---	---	---	100.0
East South America	20.0	19.3	49.6	---	---	---	11.1	100.0
Argentina	38.7	1.3	35.8	---	---	---	24.2	100.0
Brazil	3.5	35.0	61.0	---	---	---	.5	100.0
Paraguay	5.5	11.0	80.8	---	---	---	2.7	100.0
Uruguay	53.6	8.5	25.1	---	---	---	12.8	100.0
Venezuela .....	.1	18.5	81.4	---	---	---	---	100.0
Subtotal less Argentina ...	5.6	33.1	60.2	---	---	---	---	100.0
West South America	28.5	21.3	35.8	---	---	---	14.4	100.0
Bolivia	13.5	9.0	55.4	---	---	---	22.1	100.0
Chile	70.1	5.6	9.2	---	---	---	15.1	100.0
Colombia	7.2	29.1	57.8	---	---	---	5.9	100.0
Ecuador	14.2	34.4	30.8	---	---	---	20.6	100.0
Peru	14.4	30.9	33.1	---	---	---	21.6	100.0

Continued--

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
North Africa	35.8	12.9	14.4	16.1	---	.6	20.2	100.0
Algeria	63.2	.5	.5	33.8	---	1.9	.1	100.0
United Arab Republic	28.4	27.1	29.5	2.8	---	---	12.2	100.0
Libya	26.3	---	.7	73.0	---	---	---	100.0
Morocco	46.2	.7	.1	39.8	---	.6	12.6	100.0
Sudan	1.7	---	2.6	---	---	---	95.7	100.0
Tunisia	73.2	---	---	24.8	1.3	.7	---	100.0
West Africa	.2	6.3	15.2	---	---	---	78.3	100.0
Cameroon	---	2.1	38.9	---	---	---	59.0	100.0
Central African Republic	---	4.9	54.1	---	---	---	41.0	100.0
Chad	.3	3.9	1.3	---	---	---	94.5	100.0
Congo (Brazzaville)	---	44.4	55.6	---	---	---	---	100.0
Dahomey	---	.6	75.7	---	---	---	23.7	100.0
Gabon	---	33.3	66.7	---	---	---	---	100.0
Gambia	---	39.4	---	---	---	---	60.6	100.0
Ghana	---	8.2	45.9	---	---	---	45.9	100.0
Ivory Coast	---	44.9	36.0	---	---	---	19.1	100.0
Mali	.4	15.4	5.9	---	---	---	78.3	100.0
Mauritania	---	---	4.6	---	---	---	95.4	100.0
Niger	.1	1.4	.3	---	---	---	98.2	100.0
Nigeria	.3	3.6	14.2	---	---	---	81.9	100.0
Senegal	---	15.5	6.0	---	---	---	78.5	100.0
Togo	---	---	---	---	---	---	---	---
Upper Volta	---	3.9	9.8	---	---	---	86.3	100.0

Continued--

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
East Africa	2.9	10.9	39.5	---	---	---	46.7	100.0
Ethiopia	5.8	---	14.8	---	---	---	79.4	100.0
Kenya	6.4	1.0	71.0	---	---	---	21.6	100.0
Malagasy	---	94.0	5.9	---	---	---	.1	100.0
Malawi	---	.8	99.2	---	---	---	---	100.0
Rhodesia	.2	.4	79.6	---	---	---	19.8	100.0
Tanzania	1.0	4.9	31.0	---	---	---	63.1	100.0
Uganda	---	.6	22.1	---	---	---	77.3	100.0
Zambia	.2	---	62.7	---	---	---	37.1	100.0
West Asia	53.6	4.3	3.7	14.8	2.8	2.1	18.7	100.0
Iran	65.3	15.8	---	---	---	---	18.9	100.0
Iraq	44.4	5.4	---	---	---	---	50.2	100.0
Israel	39.7	---	6.4	31.9	---	.7	21.3	100.0
Jordan	69.5	---	---	---	---	---	30.5	100.0
Lebanon	69.3	---	---	---	---	---	30.7	100.0
Saudi Arabia	54.7	1.7	---	---	---	---	43.6	100.0
Syria	65.0	---	---	---	---	---	35.0	100.0
Turkey	53.4	1.8	6.4	25.8	4.8	3.6	4.2	100.0
Yemen	2.4	---	---	---	---	---	97.6	100.0

Continued--

Appendix table 7.--World grain production, percentage distribution by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- Percent -----							
South Asia	15.7	61.1	4.3	2.6	---	---	16.3	100.0
Afghanistan	61.9	8.7	---	---	---	---	29.4	100.0
Ceylon	---	96.9	1.0	---	---	---	2.1	100.0
India	12.4	56.2	4.8	3.1	---	---	23.5	100.0
Pakistan	18.9	74.9	2.4	.9	---	---	2.9	100.0
East Asia-Pacific Islands	1.2	80.9	11.9	5.4	---	---	.6	100.0
Indonesia	---	84.6	15.4	---	---	---	---	100.0
Korea	4.2	68.4	---	25.1	---	---	2.3	100.0
Malaysia	---	99.5	---	.5	---	---	---	100.0
Philippines	---	75.0	25.0	---	---	---	---	100.0
Taiwan	1.3	97.0	1.3	---	---	---	.4	100.0
Southeast Asia .....	.1	95.0	4.4	---	---	---	.5	100.0
Burma .....	.2	98.1	.6	---	---	---	1.1	100.0
Thailand	---	92.3	7.7	---	---	---	---	100.0
World total	26.3	23.8	22.3	8.6	3.9	5.9	9.2	100.0

Source: see app. table 11.

Appendix table 8.--World livestock production by type of product,
by region or country, 1962

Region or country	Meats				Milk	Eggs
	Pork	Poultry	Bovine	Other : 1,000 m.t.	Total	
Developed countries	12,356	5,404	15,840	5,795	39,395	8,682
United States	5,430	3,265	7,747	1,483	17,925	3,806
Canada	449	260	693	98	1,500	293
European Community	3,695	1,042	3,491	1,270	9,498	1,974
Belgium-Luxembourg	207	85	197	60	549	165
Netherlands	409	99	245	57	810	323
France	1,007	474	1,515	702	3,698	529
Germany, West	1,735	122	1,019	263	3,139	525
Italy	337	262	515	188	1,302	432
EFTA	1,890	491	1,662	872	4,915	1,195
Austria	242	22	147	18	429	75
Denmark	671	79	242	62	1,054	111
Norway	56	3	57	30	146	32
Portugal	50	12	45	50	157	31
Sweden	214	15	150	29	408	95
Switzerland	138	8	108	32	286	29
United Kingdom	519	352	913	651	2,435	822
Subtotal less U.K.	1,371	139	749	651	2,480	373
Other Western Europe	407	150	616	482	1,655	417
Greece	40	23	42	89	194	73
Ireland	110	18	299	108	535	47
Spain	117	108	170	246	641	243
Japan	260	117	172	217	766	779
South Africa, Republic of	56	28	470	159	713	66
Oceania	169	51	989	1,214	2,423	152
Australia	127	47	729	682	1,585	118
New Zealand	42	4	260	532	838	34

Continued --

Appendix table 8.--World livestock production by type of product,
by region or country, 1962 -- continued

Region or country	Meats					Milk	Eggs
	Pork	Poultry	Bovine	Other	Total		
	----- 1,000 m.t. -----						
Central plan countries	7,668	1,509	5,580	2,399	17,156	85,141	2,851
Soviet Union	2,650	766	3,490	1,154	8,060	52,667	1,498
Eastern Europe	2,808	493	1,215	410	4,926	31,224	978
Bulgaria	78	39	69	14	200	1,110	60
Czechoslovakia	373	57	139	57	626	3,845	124
Germany, East	531	67	190	79	867	6,004	170
Hungary	326	99	109	51	585	2,009	103
Poland	959	63	301	130	1,453	12,516	309
Romania	231	70	198	48	547	2,810	119
Yugoslavia	269	67	195	49	580	2,499	80
Communist Asia	2,210	250	875	835	4,170	1,250	375
China	2,120	240	840	800	4,000	1,200	357
North Vietnam	---	---	---	---	100	---	---

Continued --

Appendix table 8.--World livestock production by type of product,
by region or country, 1962 -- continued

Region or country	Meats					Milk	Eggs
	Pork	Poultry	Bovine	Other	Total		
				1,000 m.t.			
Less developed countries	3,021	1,241	10,420	3,816	18,499	74,275	2,496
Middle America	399	85	855	86	1,425	4,351	338
Mexico	247	46	415	63	771	2,321	202
Costa Rica	3	2	34	---	39	122	3
El Salvador	10	2	20	---	32	110	8
Guatemala	8	3	41	2	54	147	8
Honduras	7	3	19	---	29	128	9
Nicaragua	6	2	37	---	45	192	4
Panama	4	2	30	---	36	52	5
East South America	847	230	5,170	432	6,679	11,453	417
Argentina	149	31	2,911	266	3,357	4,582	139
Brazil	611	145	1,656	82	2,494	5,449	224
Paraguay	21	6	131	1	159	79	7
Uruguay	18	4	326	68	416	723	19
Venezuela	41	25	141	---	207	498	24
Subtotal less Argentina	698	199	2,259	166	3,322	6,843	278
West South America	201	53	889	177	1,320	3,479	107
Bolivia	12	1	39	30	82	87	4
Chile	35	10	143	63	251	806	23
Colombia	75	22	526	7	630	1,860	45
Ecuador	30	5	50	15	100	220	9
Peru	49	15	131	62	257	506	26

Continued --

Appendix table 8.--World livestock production by type of product, by region or country, 1962 -- continued

Continued --

Appendix table 8.--World livestock production by type of product,
by region or country, 1962 -- continued

Region or country	Meats					Milk	Eggs
	Pork	Poultry	Bovine	Other	Total		
				1,000 m.t.			
East Africa	62	92	954	431	1,539	3,534	130
Ethiopia	---	50	240	162	452	1,654	47
Kenya	15	7	104	41	167	428	10
Malagasy	14	---	65	19	98	33	11
Malawi	5	2	4	3	14	27	2
Rhodesia	---	---	150	70	220	205	15
Tanzania	5	5	109	11	130	186	8
Uganda	2	2	54	25	83	152	5
Zambia	5	5	18	3	31	59	3
West Asia	---	105	526	1,124	1,153	12,671	298
Iran	---	37	98	202	337	2,120	34
Iraq	---	4	43	86	133	1,208	10
Israel	---	---	14	64	78	296	67
Jordan	---	2	4	15	21	62	2
Lebanon	---	14	25	22	61	69	2
Saudi Arabia	---	5	5	55	65	142	7
Syria	---	4	10	54	68	315	9
Turkey	---	---	143	247	390	2,960	65

Continued --

Appendix table 8.--World livestock production by type of product,
by region or country, 1962 -- continued

Region or country	Meats					Milk	Eggs
	Pork	Poultry	Bovine	Other	Total		
	1,000 m.t.						
South Asia	42	155	592	621	1,410	32,613	143
Afghanistan	---	4	44	110	158	1,248	12
Ceylon	3	3	15	5	26	135	10
India	31	92	237	403	763	21,761	87
Pakistan	---	44	268	88	400	8,005	28
East Asia-Pacific Islands ..	1,111	203	203	48	1,565	67	421
Indonesia	---	---	---	---	535	25	230
Korea	67	12	31	9	119	5	30
Malaysia	41	38	13	2	94	14	22
Philippines	328	48	70	1	439	10	82
Taiwan	211	22	7	3	243	7	21
Southeast Asia	275	92	352	46	765	258	292
Burma	---	---	---	---	90	159	97
Thailand	158	53	202	26	439	6	105
World total	23,045	8,155	31,840	12,010	75,050	346,880	13,929

Source: see app. table 11.

Appendix table 9.--World grain consumption by livestock by type of grain, by region or country, 1962

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
				1,000 m.t.				
Developed countries	10,948	280	98,936	29,206	3,692	31,114	6,737	180,913
United States	931	226	79,927	5,313	222	12,820	11	99,450
Canada	1,369	---	1,103	2,439	81	5,393	19	10,404
European Community	4,924	27	10,944	7,991	2,804	7,385	1,906	35,981
Belgium-Luxembourg	43	1	513	439	186	506	476	2,164
Netherlands	244	7	1,474	378	428	510	816	3,857
France	2,861	15	2,189	3,922	298	2,462	422	12,169
Germany, West	1,695	1	900	2,577	1,824	3,325	139	10,461
Italy	81	3	5,868	675	68	582	53	7,330
EFTA	2,475	---	4,244	9,642	318	3,711	1,594	21,984
Austria	100	---	508	507	42	299	60	1,516
Denmark	129	---	172	2,959	198	610	795	4,863
Norway	63	---	89	367	1	106	54	680
Portugal	---	---	196	30	---	62	1	289
Sweden	141	---	48	845	61	1,006	460	2,561
Switzerland	105	---	125	317	12	150	43	752
United Kingdom	1,937	---	3,106	4,617	4	1,478	181	11,323
Subtotal less U.K.	538	---	1,138	5,025	314	2,233	1,413	10,661
Other Western Europe	175	5	1,712	2,913	263	1,109	130	6,307
Greece	20	5	242	241	5	128	---	641
Ireland	98	---	116	320	1	324	1	860
Spain	3	---	1,160	1,818	214	423	19	3,637
Japan	557	22	---	700	---	---	2,928	4,207
South Africa, Republic of	5	---	883	15	4	51	4	962
Oceania	512	---	123	193	---	645	145	1,618
Australia	394	---	117	175	---	627	145	1,458
New Zealand	118	---	6	18	---	18	---	160

Continued--

Appendix table 9.--World grain consumption by livestock by type of grain,
by region or country, 1962 -- continued

[illegible]

Continued--

Appendix table 9.--World grain consumption by livestock by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- 1,000 m.t. -----							
Less developed countries	1,510	615	12,357	5,471	384	815	2,806	23,958
Middle America	635	89	1,668	73	---	41	684	3,190
Mexico	424	26	1,003	52	---	29	323	1,857
Costa Rica	---	22	---	---	---	---	---	22
El Salvador	6	2	13	---	---	---	73	94
Guatemala	15	1	36	---	---	---	10	62
Honduras	2	2	59	---	---	---	37	100
Nicaragua	---	3	37	---	---	---	36	76
Panama	1	8	31	---	---	---	---	40
East South America	135	10	8,565	357	352	355	568	10,342
Argentina	135	10	1,916	357	352	355	501	3,626
Brazil	---	---	6,293	---	---	---	7	6,300
Paraguay	---	---	24	---	---	---	4	28
Uruguay	---	---	177	---	---	---	39	216
Venezuela	---	---	79	---	---	---	---	79
Subtotal less Argentina :	---	---	6,649	---	---	---	67	6,716
West South America	---	---	505	---	---	---	263	768
Bolivia	---	---	49	---	---	---	10	59
Chile	---	---	146	---	---	---	171	317
Colombia	---	---	216	---	---	---	38	254
Ecuador	---	---	21	---	---	---	10	31
Peru	---	---	73	---	---	---	34	107

Continued--

Appendix table 9.--World grain consumption by livestock by type of grain,
by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- 1,000 m.t. -----							
North Africa	214	2	303	899	---	39	58	1,515
Algeria	---	---	4	159	---	16	1	180
United Arab Republic	---	---	252	112	---	---	36	400
Libya	14	---	---	57	---	---	5	76
Morocco	169	2	45	494	---	14	10	734
Sudan	---	---	1	---	---	---	6	7
Tunisia	31	---	1	77	---	9	---	118
West Africa	---	3	90	---	---	---	13	106
Cameroon	---	---	11	---	---	---	10	21
Central African Republic ..	---	---	1	---	---	---	---	1
Chad	---	---	---	---	---	---	---	---
Congo (Brazzaville)	---	---	---	---	---	---	---	---
Dahomey	---	---	---	---	---	---	---	---
Gabon	---	---	---	---	---	---	---	---
Gambia	---	2	---	---	---	---	---	2
Ghana	---	---	3	---	---	---	---	3
Ivory Coast	---	---	2	---	---	---	---	2
Mali	---	---	---	---	---	---	---	---
Mauritania	---	---	---	---	---	---	---	---
Niger	---	---	---	---	---	---	---	---
Nigeria	---	---	52	---	---	---	---	52
Senegal	---	---	1	---	---	---	---	1
Togo	---	---	---	---	---	---	---	---
Upper Volta	---	---	---	---	---	---	---	---

Continued--

Appendix table 9.--World grain consumption by livestock by type of grain, by region or country, 1962 -- continued

[illegible]

Appendix table 9.--World grain consumption by livestock by type of grain, by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
					1,000 m.t.			
South Asia	141	208	108	370	---	---	336	1,163
Afghanistan	---	---	---	---	---	---	100	100
Ceylon	2	1	---	---	---	---	---	3
India	136	204	82	336	---	---	200	958
Pakistan	---	---	24	28	---	---	31	83
East Asia-Pacific Islands ..	11	132	562	59	---	---	56	820
Indonesia	---	---	255	---	---	---	---	255
Korea	10	---	---	55	---	---	47	112
Malaysia	---	---	47	---	---	---	---	47
Philippines	---	41	208	---	---	---	1	250
Taiwan	---	83	17	---	---	---	5	105
Southeast Asia	---	171	43	---	---	---	---	214
Burma	---	118	---	---	---	---	---	118
Thailand	---	---	30	---	---	---	---	30
World total	18,076	895	130,342	47,723	10,532	42,767	16,344	266,679

Source: see app. table 11.

Appendix table 10.--World grain production, by type of grain, by region or country, 1962

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
				1,000 m.t.				
Developed countries	96,434	16,587	111,454	41,283	7,166	35,229	3,166	311,319
United States	33,306	2,710	95,747	9,023	833	14,646	18	156,283
Canada	14,649	---	903	3,743	274	6,127	84	25,780
European Community	26,157	508	6,397	10,709	4,292	7,380	598	56,041
Belgium-Luxembourg	871	---	2	478	148	484	0	1,983
Netherlands	693	---	---	374	354	426	47	1,894
France	11,745	---	2,625	6,261	395	2,628	514	24,168
Germany, West	4,587	---	39	3,330	3,306	3,317	---	14,579
Italy	8,261	508	3,731	266	89	525	37	13,417
EFTA	6,226	170	775	11,371	1,203	4,247	1,478	25,470
Austria	712	---	202	576	388	336	69	2,283
Denmark	487	---	---	3,241	418	693	697	5,536
Norway	22	---	---	423	3	139	3	590
Portugal	526	170	562	56	162	79	7	1,562
Sweden	843	---	---	1,085	159	1,253	508	3,848
Switzerland	343	---	11	99	53	42	38	586
United Kingdom	3,293	---	---	5,891	20	1,705	156	11,065
Subtotal less U.K.	2,933	170	775	5,480	1,183	2,542	1,322	14,405
Other Western Europe	6,964	372	1,421	3,362	557	1,309	133	14,118
Greece	1,770	76	266	252	23	155	11	2,553
Ireland	390	---	---	540	1	377	---	1,308
Spain	4,122	272	993	1,953	402	504	22	8,268
Japan	1,380	12,736	---	1,593	---	---	371	16,080
South Africa, Republic of	702	---	6,025	43	7	99	212	7,088
Oceania	7,050	91	186	1,439	---	1,421	272	10,459
Australia	6,817	91	172	1,363	---	1,384	272	10,099
New Zealand	233	---	14	76	---	37	---	360

Continued--

Appendix table 10.--World grain production, by type of grain, by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
	----- 1,000 m.t. -----							
Central plan countries	89,785	59,528	34,913	23,541	26,502	16,178	25,548	275,995
Soviet Union	50,084	218	8,467	10,994	14,563	10,160	3,415	97,901
Eastern Europe	17,221	150	16,981	6,632	11,939	4,838	2,033	59,794
Bulgaria	2,278	33	1,478	598	86	223	12	4,708
Czechoslovakia	1,616	---	512	1,598	952	---	969	5,637
Germany, West	4,587	---	39	3,330	3,306	3,317	---	14,579
Hungary	1,871	47	3,259	1,021	365	200	---	6,763
Poland	2,526	---	33	1,230	8,116	2,732	490	15,127
Romania	3,813	45	5,650	441	112	291	---	10,352
Yugoslavia	3,623	21	5,793	558	230	403	40	10,668
Communist Asia	22,480	59,160	9,465	5,915	---	1,180	20,100	118,300
China	21,470	56,500	9,040	5,650	---	1,130	19,210	113,000
North Vietnam	635	1,670	270	170	---	35	560	3,340

Continued--

Appendix table 10.--World grain production, by type of grain, by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
					1,000 m.t.			
Less developed countries	45,043	132,681	49,471	10,280	571	616	51,544	290,206
Middle America	2,174	996	10,717	272	---	121	814	15,094
Mexico	1,520	306	6,484	170	---	74	333	8,887
Costa Rica	3	114	---	1	---	---	---	118
El Salvador	---	24	236	---	---	---	143	403
Guatemala	26	15	591	12	---	---	---	644
Honduras	1	23	293	---	---	---	56	373
Nicaragua	---	130	37	---	---	---	47	214
Panama	---	109	74	---	---	---	---	183
East South America	6,193	5,994	15,403	---	---	---	3,453	31,043
Argentina	5,208	170	4,810	---	---	---	3,259	13,447
Brazil	548	5,563	9,680	---	---	---	73	15,864
Paraguay	8	16	118	---	---	---	4	146
Uruguay	415	66	194	---	---	---	99	774
Venezuela	1	105	463	---	---	---	---	569
Subtotal less Argentina	985	5,824	10,593	---	---	---	194	17,596
West South America	1,577	1,180	1,982	---	---	---	796	5,535
Bolivia	61	41	251	---	---	---	100	453
Chile	1,157	92	152	---	---	---	249	1,650
Colombia	131	536	1,065	---	---	---	108	1,840
Ecuador	74	180	161	---	---	---	108	523
Peru	154	331	353	---	---	---	231	1,069

Appendix table 10.--World grain production, by type of grain, by region or country, 1962 -- continued

Region or country	Wheat	Rice	Corn	Barley	Rye	Oats	Other	Total
					1,000 m.t.			
North Africa	4,874	1,773	1,955	2,185	---	60	2,743	13,590
Algeria	1,133	9	9	606	---	34	2	1,793
United Arab Republic	1,835	1,745	1,900	180	---	---	780	6,440
Libya	40	---	1	11	---	---	---	152
Morocco	1,274	19	3	1,097	---	16	348	2,757
Sudan	28	---	42	---	---	---	1,608	1,678
Tunisia	564	---	---	191	---	10	5	770
West Africa	35	1,083	2,614	---	---	---	13,466	17,198
Cameroon	---	11	210	---	---	---	319	540
Central African Republic ..	---	3	33	---	---	---	25	61
Chad	2	27	9	---	---	---	650	688
Congo (Brazzaville)	---	4	5	---	---	---	---	9
Dahomey	---	1	216	---	---	---	69	286
Gabon	---	1	2	---	---	---	---	3
Gambia	---	28	---	---	---	---	43	71
Ghana	---	31	174	---	---	---	174	379
Ivory Coast	---	182	146	---	---	---	77	405
Mali	4	173	67	---	---	---	885	1,129
Mauritania	---	---	3	---	---	---	62	65
Niger	1	10	2	---	---	---	751	764
Nigeria	16	262	1,041	---	---	---	6,067	7,386
Senegal	---	70	27	---	---	---	354	451
Togo	---	---	---	---	---	---	185	185
Upper Volta	---	35	87	---	---	---	767	889

Continued--

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references for appendix tables 1-10

Region or country	Data period 1/ Annual average	Sources and references
Developed countries		Subtotal of regional detail
United States	1960-64	OECD Food Consumption Statistics 1954-1966 (Paris 1968): grain
Canada	do.	balances do not include sorghum
EEC	do.	do.
		Sum of EEC detail
Belgium-Luxembourg	do.	OECD Food Consumption Statistics 1954-1966 (Paris 1968)
Netherlands	do.	do.
France	do.	do.
Germany, West	do.	do.
Italy	do.	do.
		Sum of EFTA detail
EFTA	do.	OECD Food Consumption Statistics 1954-1966 (Paris 1968)
Austria	do.	do.
Denmark	do.	do.
Norway	do.	do.
Portugal	do.	do.
Sweden	do.	do.
Switzerland	do.	do.
United Kingdom	do.	do.
Subtotal less U.K.	do.	OECD Food Consumption Statistics 1954-1966 (Paris 1968)
		Sum of EFTA detail less U.K.
Other Western Europe	1962	Sum of country detail expanded to regional level assuming per
		capita detail in remaining areas the same as average of country
		detail in this region plus EFTA
Greece	do.	OECD Food Consumption Statistics 1954-1966 (Paris 1968)
Ireland	1960-64	do.
Spain	1961/2-62/3	do.
		do.
Japan	1960-64	OECD Food Consumption Statistics 1954-1966 (Paris 1968)
South Africa, Republic of	1962/63	Government of South African Republic official figures
Oceania	1961/62-62/63	Sum of Australia and New Zealand
		do.
Australia	do.	Government of Australia official figures
New Zealand	do.	Government of New Zealand official figures

Note: see footnote at end of table.

Continued --

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references
for appendix tables 1-10--continued

Region or country	:	Data	:	period 1/	:	Sources and references
	:	Annual	:		:	
	:	<u>average</u>	:		:	
Central plan countries	:		:		:	:Subtotal of regional detail
Soviet Union	:	1959-61	:		:	:Food Balances for 8 East European Countries 1959-61, ERS-
	:		:		:	:Foreign 124
Eastern Europe	:	do.	:		:	:Sum of Eastern European detail
	:		:		:	
Bulgaria	:	do.	:		:	:Food Balances for 8 East European Countries 1959-61, ERS-
	:		:		:	:Foreign 124
Czechoslovakia	:	do.	:		:	do.
Germany, West	:	do.	:		:	do.
Hungary	:	do.	:		:	do.
Poland	:	do.	:		:	do.
Romania	:	do.	:		:	do.
Yugoslavia	:	do.	:		:	do.
	:		:		:	
Communist Asia	:	1962	:		:	:Rough estimates based on preliminary tabulations
	:		:		:	
China	:		:		:	
North Vietnam	:		:		:	
	:		:		:	
Note: see footnote at end of table						

Continued--

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references for appendix tables 1-10--continued

Region or country	Data period 1/ Annual average	Sources and references
Less developed countries		: Subtotal of regional detail
Middle America	1961-63	: Sum of country detail expanded to regional level, assuming : per capita detail in remaining areas the same as average of : country detail
Mexico	do.	: Computed from FAO food balance data
Costa Rica	do.	do.
El Salvador	do.	do.
Guatemala	do.	do.
Honduras	do.	do.
Nicaragua	do.	do.
Panama	do.	do.
East South America	1962	: Sum of country detail expanded to regional level, assuming : per capita detail in remaining areas the same as average of : country detail
Argentina	do.	: FAO. Indicative World Plan, Provisional Regional Study : No. 2 1975-1985
Brazil	do.	do.
Paraguay	do.	do.
Uruguay	do.	do.
Venezuela	do.	do.
Subtotal less Argentina..	do.	: Regional estimate less Argentina
West South America	do.	: Sum of country detail
Bolivia	do.	: FAO. Indicative World Plan, Provisional Regional Study : No. 2 1975-1985
Chile	do.	do.
Colombia	do.	do.

Note: see footnote at end of table

Continued

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references for appendix tables 1-10--continued

Region or country	:	Data	:	period 1/	:	Sources and references
	:	Annual	:		:	
	:	<u>average</u>	:		:	
Ecuador	:	1962	:		:	:FAO. Indicative World Plan, Provisional Regional Study
Peru	:	do.	:		:	:No. 2 1975-1985
	:		:		:	do.
North Africa	:	1964	:		:	
	:		:		:	:Sum of country detail expanded to regional level, assuming
	:		:		:	:per capita detail in remaining areas the same as average of
	:		:		:	:country detail
Algeria	:	do.	:		:	:Computed from FAO food balance data
United Arab Republic	:	do.	:		:	do.
Libya	:	do.	:		:	do.
Morocco	:	do.	:		:	do.
Sudan	:	do.	:		:	do.
Tunisia	:	do.	:		:	do.
West Africa	:	1962	:		:	
	:		:		:	:Sum of country detail expanded to regional level, assuming
	:		:		:	:per capita detail in remaining areas the same as average of
	:		:		:	:country detail
	:		:		:	:FAO. Indicative World Plan. Provisional Regional Study
	:		:		:	:No. 3, 1975-1985
Cameroon	:	do.	:		:	do.
Central African Republic ..	:	do.	:		:	do.
Chad	:	do.	:		:	do.
Congo (Brazzaville)	:	do.	:		:	do.
Dahomey	:	do.	:		:	do.
Gabon	:	do.	:		:	do.
Gambia	:	do.	:		:	do.
Ghana	:	do.	:		:	do.
Ivory Coast	:	do.	:		:	do.
Mali	:	do.	:		:	do.
Mauritania	:	do.	:		:	do.

Note: see footnote at end of table.

Continued--

Region or country	Data period 1/ Annual average	Sources and references
Niger	1962	:FAO. Indicative World Plan. Provisional Regional Study :No. 3, 1975-1985
Nigeria	do.	do.
Senegal	do.	do.
Togo	do.	do.
Upper Volta	do.	do.
East Africa	1962*	:Sum of country detail expanded to regional level, assuming :per capita detail in remaining areas the same as average of :country detail
Ethiopia	1962	:FAO. Indicative World Plan, Provisional Regional Study No. 3, :Africa South of the Sahara
Kenya	do.	do.
Malagasy	do.	do.
Malawi	do.	do.
Rhodesia	1959-61	:Food Balances for 30 countries, Africa and West Asia ERS-119
Tanzania	1962	:FAO. Indicative World Plan. Provisional Regional Study :No. 3, 1975-1985
Uganda	do.	do.
Zambia	do.	do.
West Asia	do.	:Sum of country detail expanded to regional level, assuming :per capita detail in remaining areas the same as average of :country detail
Iran	do.	:FAO. Indicative World Plan, Subregional Study No. 1, :Vol. 2. Near East
Iraq	do.	do.

Note: see footnote at end of table.

Continued--

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references for appendix tables 1-10--continued

Region or country	Data period 1/ Annual average	Sources and references
Israel	1962	:FAO. Indicative World Plan, Subregional Study No. 1, :Vol. 2. Near East
Jordan	do.	:do.
Lebanon	do.	:do.
Saudi Arabia	do.	:do.
Syria	do.	:do.
Turkey	do.	:do.
Yemen	do.	:do.
South Asia	1962	:Sum of country detail expanded to regional level, assuming :per capita detail in remaining areas the same as average of :country detail
Afghanistan	do.	:FAO. Indicative World Plan for Agricultural Development, :Subregional Study No. 1, Vol. II, Near East
Ceylon	do.	:FAO. Indicative World Plan, Provisional Regional Study :No. 4. Asia and Far East
India	do.	:do.
Pakistan	do.	:do.
East Asia-Pacific Islands ..	1959-61	:Sum of country detail expanded to regional level assuming :per capita detail in remaining areas the same as average of :country detail
Indonesia	do.	:Food Balances for 12 countries in the Far East and Oceania :1959-61, ERS-88
Korea	do.	:do.
Malaysia	do.	:do.
Philippines	do.	:do.
Taiwan	do.	:do.

Note: see footnote at end of table.

Continued--

Appendix table 11.--World grain and meat production, trade and utilization balances, sources and references
for appendix tables 1-10--continued

Region or country	Data period 1/ Annual average	Sources and references
Southeast Asia	1962*	:Sum of country detail expanded to regional level, assuming :per capita detail in remaining areas the same as average of :country detail
Burma	1959-61	:Food balance for 12 countries in the Far East Oceania, ERS-88
Thailand	1962	:FAO. Indicative World Plan, Provisional Regional Study :No. 4, 1975-1985
World total	1962*	:Grand total of regional totals obtained for the purpose of :interpreting the grain-meat ratio.

1/ Data tend to be centered on the year 1962 except where noted in detail in this column. An asterisk
beside the date for a total is to call attention to a chronological ambiguity in the data for that region.



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